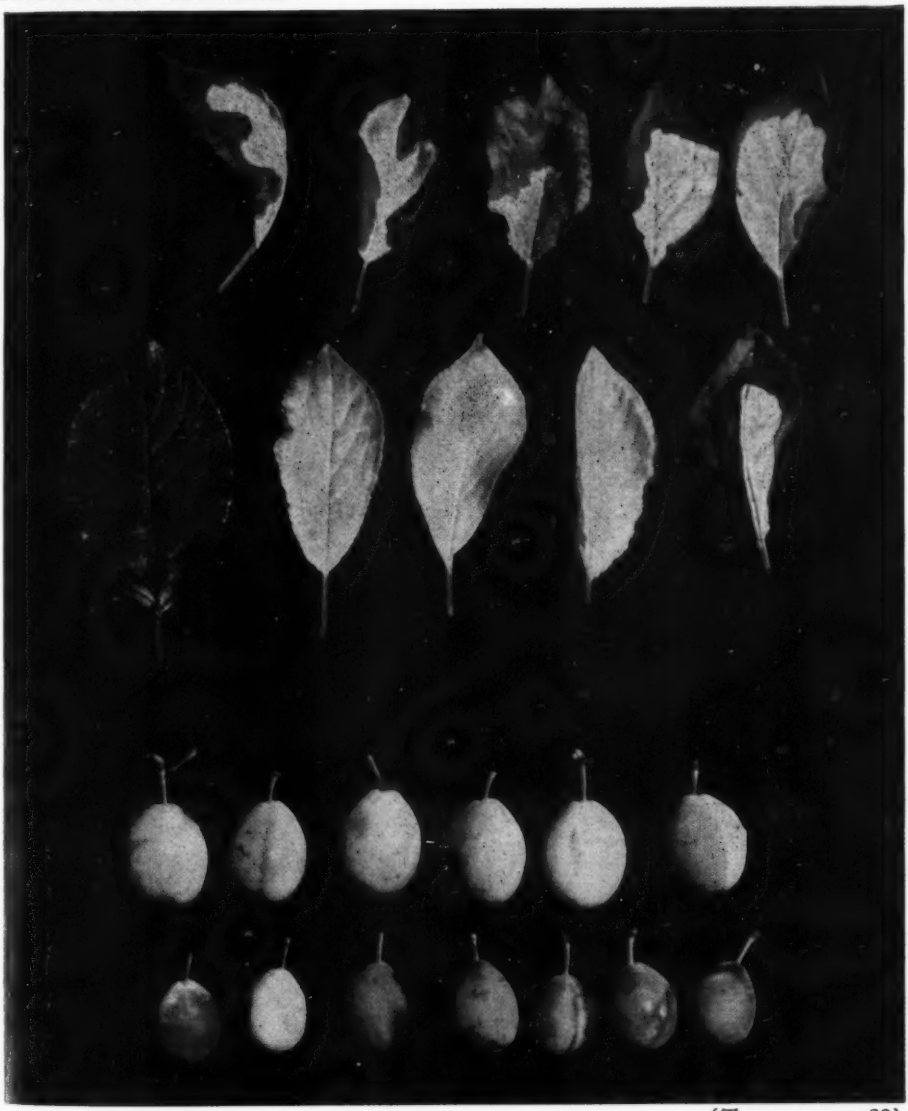
Better Crops WITH PLANT FOOD

March 1952 10 Cents



(*Turn to page* 32)

The Pocket Book of Agriculture

INTRODUCING the New

AGRICULTURAL PENTAHYDRATE BORAX

The introduction of this new product to the agricultural trade represents an achievement in product research and development designed to provide a high analysis fertilizer grade Borax at minimum cost.

CHARACTER OF PRODUCT Contains a minimum of 44% B_2O_3 or approximately 121% equivalent Borax.

ADVANTAGE More economical because the Borate which comes to you in this form is more concentrated.

PURPOSE To correct a deficiency of Boron in the soil and thus enhance the productivity of crops.

RECOMMENDED USES As an addition to mixed fertilizer, or for direct application to the soil.

FOR CORRECT APPLICATION Consult your local County Agent or State Experimental Station.

A member of the well-known "Three Elephant" Boron product family.

AMERICAN POTASH & CHEMICAL CORPORATION

122 EAST 42nd STREET • • • NEW YORK 17, N. Y.

231 S. LA SALLE STREET
CHICAGO 4, ILLINOIS

214 WALTON BUILDING
ATLANTA 3, GEORGIA

3030 WEST SIXTH STREET
LOS ANGELES 54, CALIF.

"Pioneer Producers of Muriate in America"

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1102 16th Street, N. W., Washington 6, D. C.

VOLUME XXXVI NO. 3

TABLE OF CONTENTS, MARCH 1952

Gullible's Ravels 3
Jeff Discusses Federal Workers

Alabama's Experience With Alfalfa 6
J. Olan Cooper Reports Progress Made

The Relative Merits of Inorganic and Organic Sources of Plant Nutrients 9
J. S. Joffe Presents the Pros and Cons

The Magic of Nitrogen 13
C. J. Chapman Explains Some Examples

Inventorying Soil Improvement 17
Ford S. Prince Details Some Results

Master Cotton Farmer, Shelby County, Alabama 23
Bill Nichols Tells How It Was Done

Pastures Pay Profits in Louisiana 25
Fred J. Hurst Supplies the Proof

The American Potash Institute, Inc.

1102 16th Street, N. W., Washington 6, D. C.

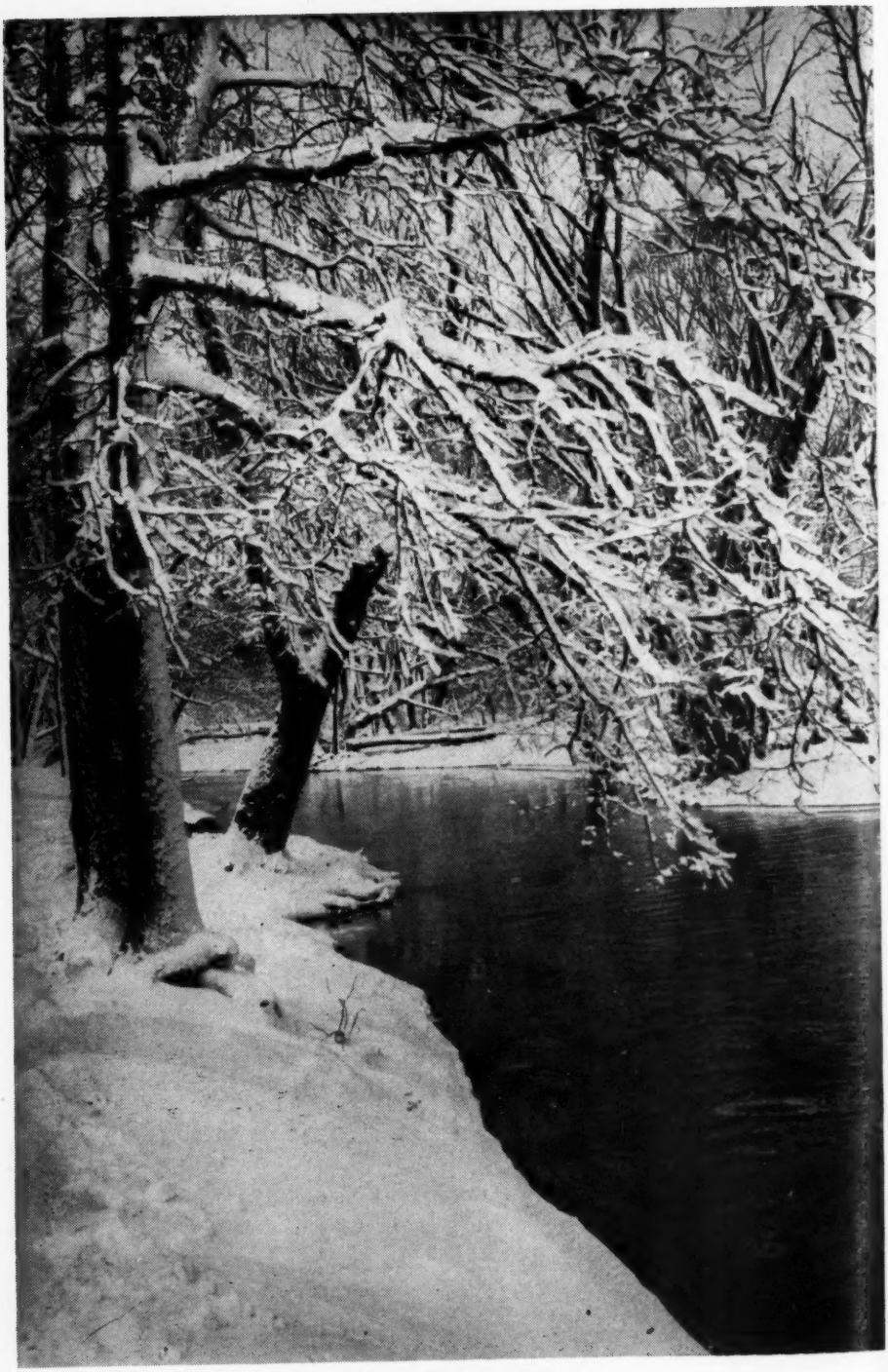
Member Companies: American Potash and Chemical Corporation
United States Potash Company
Potash Company of America

Washington Staff

H. B. Mann, *President*
J. W. Turrentine, *President Emeritus*
J. D. Romaine, *Chief Agronomist*
R. H. Stinchfield, *Publications*
Mrs. H. N. Hudgins, *Librarian*

Branch Managers

S. D. Gray, *Washington, D. C.*
J. F. Reed, *Atlanta, Ga.*
G. N. Hoffer, *Lafayette, Ind.*
M. E. McCollam, *San Jose, Calif.*
E. K. Hampson, *Hamilton, Ont.*



The Last of Winter—We Hope!

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1102 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY. COPYRIGHT, 1952, BY THE AMERICAN POTASH INSTITUTE, INC.

VOL. XXXVI WASHINGTON, D. C., MARCH 1952 No. 3

Let's Call It . . .

Gullible's Ravels

Jeff McDermid

ALL ye who like myths and scandals should be advised that a modern replica of Captain Gulliver has been making regular voyages in his ancient barkentine during recent seasons, under the new name of Master Maligner Gullible. He remains the same old satirical critic of yore, when the pot-hoisters and jesters of another Elizabethan era shook the rafters in merriment over the flunkies who worked for the strange and twisted governments of Brobdingnag, Glubdurdrib, Houyhnhmn, Laputa, and Lilliput.

Only this time Captain Gullible has not found it advisable to dwell so much upon the questionable antics and misdemeanors of distant foreign governments in quest of victims for a prodigious spree of the imagination. He simply moors his rickety craft in the Potomac estuary and aims his shafts of burning ridicule at the suburban busloads and car pools homeward bound after a welter of wasted hours and unearned wages in the Federal triangle.

But from this point onward we will merely ignore the romances which spring from the logbook of Captain Gullible, and set down a very plain and unadorned chapter of facts about Federal workers. Americans are usually fair-minded and like to hear truth as well as fiction, so what follows is the best we can dig up from the annals of that public employment service that tries its best at all times to be "civil"—even when provoked by rumor mongers.

We are not here to sell you anything in the nature of a "bill of goods." But we feel that the "bill of rights" is part

of the inheritance of every loyal American, even though he lives in the goldfish bowl of civil service.

Let it be understood that you can't take a certain moment of the day and announce that there are "just so many" numbers of workers employed by Uncle Sam. Human shiftings and changes take place constantly, so all we can do now is to settle on an agreed base of average Federal employment. For want of anything better, these figures to follow are the average roll call of government workers during the last quarter (October-December) of 1951.

Moreover, it's no more use to compare the numbers under hire in this specified period with the Republican or Democratic terms of McKinley or Wilson than it would be to compare the inventions and gadgets and varieties of food we have enjoyed in those same respective eras, alongside the ones we are trying to be contented with now.

SO we find upon application to government personnel offices that in the final quarter of last year Uncle Sam had 2,503,641 employees in the executive branch of service. Of these persons, 2,330,388 were working right inside the continental United States, leaving some 170,000 holding overseas jobs. Living and working within the Washington, D. C. zone there were then approximately 250,000 persons. Exactly 93 per cent of the hired crew working inside U.S.A. were strictly under the rules of the civil service. That left only about 7 per cent whose jobs were of an exempt or perhaps a political nature in relation to their appointment.

Of the full roster of 2,330,388 who were working on the domestic scene, 92 per cent were on the full-time payrolls, leaving nearly 190,000 engaged in part-time and intermittent work. As to sex, about 75 per cent were men and 25 per cent women, or 1,749,660 and 580,728 respectively. Much is said pro and con concerning veterans' preference ratings as aids to getting and holding Federal positions. At the time under consideration, 46 per cent of the employees held some form of military or armed forces preference—95 per cent of them men, 5 per cent women, and 15 per cent disabled ex-service personnel. This left 54 per cent who boasted no service ratings or failed to rely on it for employment standing.

How are the employees in civilian work divided broadly among the services? In the Department of Defense (Secretary of Defense, and the Departments of the Army, Navy, and Air Force) there were 1,150,421 workers on the roster. This made up 49 per cent of total employment. Next came the Post Office services with 502,617 persons, or 22 per cent, followed by Veterans Administration staff, 177,949, or 8 per cent; and lastly, all other administrative and executive departments and agencies employing 499,401 persons, for the final 21 per cent.

WHAT brought in the increased employment of about 520,000 persons who were added in the fiscal year that ended last June 30? The military offices and the Selective Service hired an extra 487,200 employees during the year. The new agencies having to do with defense production and various economic controls added 15,300 workers. Civilian defense and control of subversive activities took on another 5,900 employees. Employment of women clerical workers showed the largest numerical gain through the 1950-51 fiscal year.

It stands on the record that Federal wage earners number at present several thousand more than the total employment actively listed by 50 of the largest corporations in the nation. Opinions naturally differ widely among us as to the relative worth of some of the activities taking up the time of our payrollers. Some form of activity that is meat to one man's mind is rank poison in the sight of another—both of them equally entitled to protest, if they so

desire. Back of it all, when it comes to programs and duties attached to them, Congress alone has the right to allocate the funds or to continue and expand one activity while reducing or eliminating others.

Yet the only honest way an outsider can look at it is to examine the jobs which employees are already assigned to perform through stated and formal laws and the appropriated moneys set forth in the budgets. Offhand, then,

we find that three-quarters of all our government job-holders are manning depots, arsenals, shipyards, and weapons laboratories; sorting and carrying the mails; caring for disabled veterans and handling veteran insurance programs.

This leaves about one-quarter of all our Federal workers engaged in any of the following more or less vital necessities in humdrum, everyday domestic economy: Printing our money, controlling narcotics and drugs, regulating immigration, collecting taxes and custom duties, conserving soils and conducting farm research, bringing electricity to rural homes, administering the social security system, handling atomic energy for peace or war, forecasting weather, protecting parks and forests and other natural land resources from exploitation, controlling airways, protecting food and drug standards, manning health centers and animal quarantine stations, maintaining relations with foreign nations, operating defense and technical progress plans with our foreign allies, developing flood control systems, and bringing justice to apprehend criminals, as well as conducting and deciding cases of public concern in the courts of law.

When it comes to a scanning of such a "half list" as the above, it is always noticeable that some of the items may have friends and some enemies—but, like a satisfying menu offered in a good restaurant, the service altogether must be broad and inclusive. That is, one man's tax dollar is as good as another man's as far as the routine duty of the public servant is concerned. Some law enacted sometime directed certain work to be done, and until that particular law is amended or wiped out, all the supervisors can hope to do is to maintain as adequate a staff as possible to carry it out. The one who performs the task allotted to him may not himself agree that it is entirely worthy of the time and effort spent upon it—but "his not to reason why, his but to do or die" —as long as Congress stands pat.

IT is often believed that a majority of Federal jobs are in the well-known District of Columbia—because so much news originates there, no doubt. As a matter of fact, California alone has as many government employees as Washington, D. C., and there are more post office clerks and carriers at work locally in the nation than all the Washington executive offices employ.

It has been declared without foundation that nothing ever is done officially to encourage government workers to find ways and means of saving taxpayers' money in performance of various tasks. Almost all large departments maintain a regular incentive system of modest cash awards or class promotions to workers who come forth with workable and thrifty plans of doing various tasks. Last fiscal year's records show that the government realized an estimated net saving of nearly $25 mil-

(*Turn to page* 48)

Alabama's Experience With Alfalfa

By J. Olan Cooper

Alabama Polytechnic Institute, Auburn, Alabama

BEFORE the Agricultural Experiment Station of the Alabama Polytechnic Institute discovered how to fertilize alfalfa in Alabama, this crop was grown successfully only on the lime soils of the Black Belt. Old-timers still recall stuffing "every barn and out-house on the place with high-quality alfalfa hay" some 30 years ago. That is, those who lived on the lime soils do.

Based on the results of experiments with alfalfa varieties and fertilizers which were begun in 1902, alfalfa was recommended only for the prairie soils of the Black Belt. Early researchers of the Experiment Station wondered why the other sections could not grow it. Today, however, alfalfa is much more common in these other sections of the State.

Although numerous attempts were made to produce alfalfa in other sections of Alabama, none were successful until experiments were begun at the Tennessee Valley Substation in 1931. Results of these experiments showed the need of lime and phosphate. In the beginning, no evidence of the need for potash was noted, possibly because the experiments were located on soils relatively high in potash. Later, alfalfa yields were increased from lime, phosphate, and potash.

Results of an experiment begun on the Sand Mountain Substation in 1939 revealed that alfalfa yields were increased and the life of the stand was prolonged on plots that received 200 pounds of muriate of potash per acre before planting and annual rates of 100 pounds thereafter. These results indicated that perhaps potash deficiency might be one of the chief causes of alfalfa failure throughout the State.

Subsequently, a test was planted on Norfolk soil at the Main Station, Auburn, in 1941. The plot received adequate lime and phosphate, and 50 pounds of muriate of potash. An excellent stand of alfalfa was obtained, but the crop lost its vigor, turned yellow, and appeared to be failing following the first cutting. This is what had happened in previous tests. The plot was divided into sub-plots, certain of which received additional potash and borax. Alfalfa on the sub-plots getting no additional potash and borax did not survive after the second cutting, whereas the alfalfa on the subplots that received additional potash and borax thrived throughout the year. This experiment, together with the one at the Sand Mountain Substation, gave a clue that perhaps additional potash and borax might be essential to the growth of alfalfa.

Potash—Definitely a Major Factor

In 1942 more elaborate tests with potash and boron for alfalfa were begun at Auburn and other locations in Alabama. Results of these tests proved conclusively that potash rates, higher than are needed for most crops, are required to secure and maintain alfalfa yields on most soils of the State.

Results at Auburn showed that alfalfa quickly failed without potash, and that applications of potash may have to be quite high in order to maintain the alfalfa. The effects of differ-

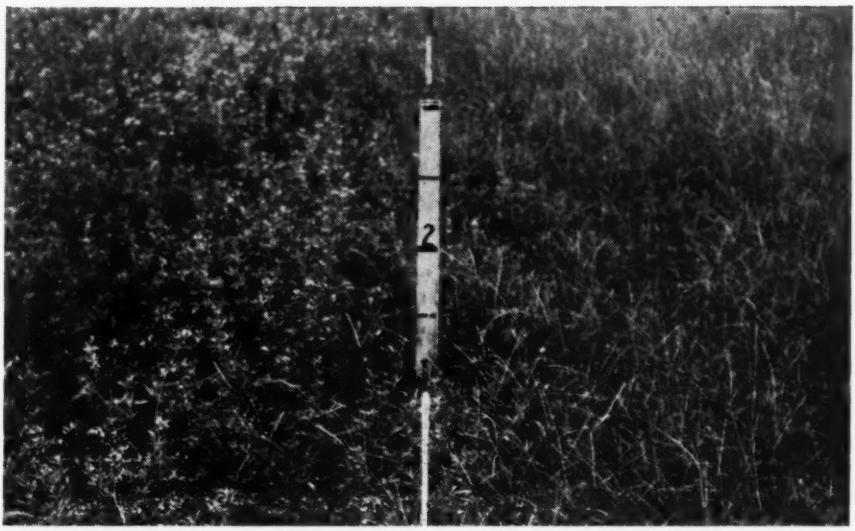


Fig. 1. A 3-year-old stand of alfalfa on Chesterfield sandy loam soil at the Main Experiment Station, Auburn, Alabama. The plot to the left of the stake received 200 lbs. of muriate of potash per acre before establishment and 200 lbs. annually thereafter. Otherwise, both plots were fertilized alike. Note the grass in the plot at the right that did not receive potash.

ent rates of potash on life of stand and yields of alfalfa where sufficient amounts of lime, phosphate, and borax were supplied in tests at the Main Station are shown in Table I.

Potash is especially important in maintaining yields and stands of alfalfa. Chemical analysis has shown that a yield of 4 tons of alfalfa hay per acre removes a minimum equivalent of about 250 pounds of muriate of potash. Further losses of soil potassium may be expected from leaching.

Even our best potash-supplying soils in the State are soon depleted by alfalfa unless liberal applications are added. As the soil potash supply decreases, alfalfa yields decrease and finally the stand is lost. Furthermore, alfalfa that is not adequately supplied with potash is forced to draw upon the native soil potassium to the point that crops following it may show extreme potash deficiency. Recent studies have shown that where annual applications of 400 pounds of muriate of potash were made to alfalfa, cotton yields were higher with normal ferti-

TABLE I

Soil type	Annual applications of muriate of potash in pounds per acre			
	0	100	200	400
Norfolk sandy loam				
Life of alfalfa stand, yrs.	1	3	3	4
Total yield alfalfa hay, tons	1.5	9.7	12.7	16.6
Chesterfield sandy loam*				
Life of alfalfa stand, yrs.	3	6	6	7
Total yield of alfalfa hay, tons	6.8	18.8	23.9	26.0

* Native potassium supplying power of Chesterfield soil is approximately twice as great as Norfolk.

lization even after several years than with very high rates of potash following alfalfa that had received only 200 pounds of muriate per acre.

Fertilizer Recommendations for Establishing Alfalfa

Fertilizer studies with alfalfa have not been conducted long enough in Alabama to permit definite general recommendations, but approximate rates which have given good results in experiments throughout Alabama are given here. Lime is applied several months ahead of seeding and is worked thoroughly into the seedbed. Fertilizers, including borax, are applied shortly before or at the time of seeding. Fertilizers applied for establishment, if used at the rates recommended, should carry the alfalfa through the first year.

Black Belt Area. At present, alfalfa is recommended only on the lime soils of this area that require no additional lime. The following rates of fertilizers are recommended: 100 pounds of P_2O_5, 180 pounds of K_2O, and 20 to 25 pounds of borax per acre.

Gulf Coast and Lower Coastal Plain Areas. The per acre rates of lime and fertilizers recommended are as follows: 4 tons of lime, 100 pounds of P_2O_5, 180 pounds of K_2O, 20 to 25 pounds of borax.

Upper Coastal Plain, Piedmont, Sand Mountain, and Coosa River Valley Areas. Lime and fertilizer rates per acre for these areas are: 2 tons of lime, 100 pounds of P_2O_5, 180 pounds of K_2O, and 20 to 25 pounds of borax.

Tennessee Valley Area. For the red soils 2 tons of lime, 100 pounds of P_2O_5, 120 pounds of K_2O, and 20 to 25 pounds of borax per acre are recommended. The grey soils should receive 3 tons of lime, 100 pounds of P_2O_5, 180 pounds of K_2O, and 20 to 25 pounds of borax per acre.

Fertilizer Recommendations for Maintaining Stands of Alfalfa

Field experiments with alfalfa have shown that annual applications of phosphate, potash, and borax must be supplied if good stands and yields are to

(*Turn to page* 42)

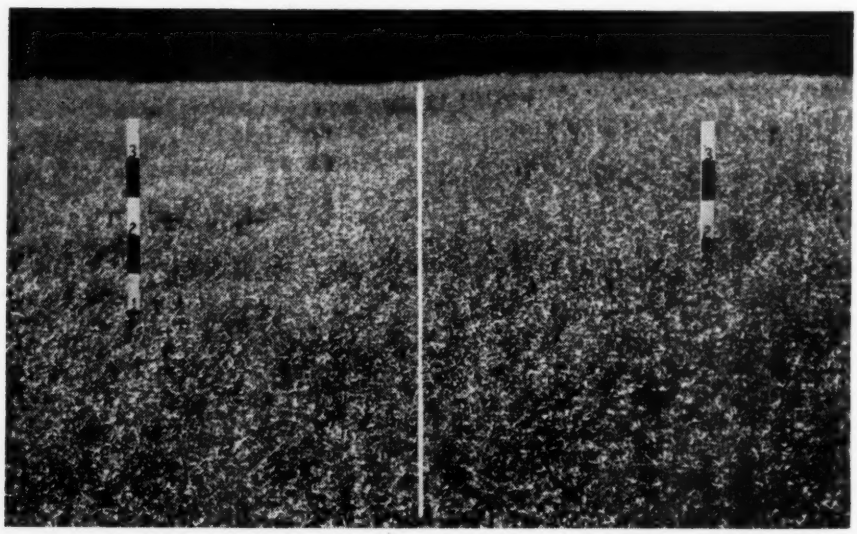


Fig. 2. Potash made the difference in height of alfalfa on the stakes. The plot at the left received 100 lbs. of muriate of potash per acre, while that on the right got the 400-lb. rate. This alfalfa is in the same field as that in Fig. 1, and both pictures were made on the same day.

The Relative Merits of Inorganic and Organic Sources Of Plant Nutrients*

By J. S. Joffe

Soils Department, Rutgers University, New Brunswick, New Jersey

PRIOR to the introduction of mineral fertilizer, a little more than 100 years ago, manures and composts were practically the only outside sources of nutrients for crops. As the early reports on spectacular results with mineral fertilizer became known, scientific agriculturists began to question the status of manure in crop production. Experimental studies had been inaugurated to test the relative merits of the sources of nutrients from manure and mineral fertilizers. Most famous are the studies at Rothamsted and Woburn in England; those of Wagner and Maercker in Germany; at Askov and Lingby in Denmark; at New Jersey, Ohio, Pennsylvania, and other states in the United States, and in many other countries. These studies were inaugurated in the middle of the last century and lasted for decades (the Rothamsted work was started in 1843 and others in the 80's and 90's of the 19th century). They have contributed a wealth of information on many phases of barnyard manure in the system of soil conditions and plant growth. We have learned a great deal about the availability of the three fundamental fertilizer elements, NPK; the effects of the accessory elements present in manures on crop yields; the influence of manure on the physical properties of soils; and the mutual relations of the biological elements in the manure and soil. Still, the original question on the relative merits of the inorganic and organic sources of plant nutrients was not answered to the satisfaction of all concerned.

While the investigations and controversies over the merits of the sources of nutrients were in progress, agriculture in the more advanced countries had turned to specialization and mechanization. These factors have eliminated manure from a great many farms, and the problem of manure versus mineral fertilizers lost its edge. Farmers have discovered that supplementing manure with some mineral fertilizer works better than manure alone. In areas where manure had practically disappeared, farmers had to resort to the exclusive use of mineral fertilizers, and they were well satisfied that crop yields would continue their upward climb. Towards the 30's of our century, the exponents of equal merit to both sources of nutrients had found full support in the Danish experiments, some in the Rothamsted experiments, and in those of other institutions in Europe and the United States. The evidence was pretty conclusive, and it seemed that there was no point in continuing the discussions. As a matter of fact, 50% of the increase in the yield of most crops for the last 100 years is attributed to the inauguration of artificial fertilizer in soil management practices.

In recent years this problem came into sharp focus once more. There appeared a boisterous group of organic farming faddists who have dug up data, out of context, from the same

* Presented at the AAAS meetings, Section O, December 27, 1951, Philadelphia, Pa.

sources to prove fallacious claims on the superiority of manure over mineral fertilizer.

The facts are that manure and mineral fertilizer cannot be fully compared as to their performance in supplying nutrients, especially N. In manure, N availability varies, depending on the soil texture, aeration, moisture supply, the type and amount of bedding, and methods of handling the manure.

With reference to the source of the manure, the higher its nitrogen content, the higher the availability. Thus, sheep manure is generally given a 48% availability, horse manure 29%, and cow manure 26%. Maercker in Germany, back in the 90's, in an extensive study on the N availability of manure found it to vary from 60% to 13.8%, depending on some of the factors enumerated above. Paul Wagner, a contemporary of Maercker, considered 25% availability as the average. A somewhat higher availability was reported by Lipman and Blair at the New Jersey Station.

On the other hand, the availability of nitrates had been reported as 50-60%. In the light of our present knowledge, inorganic sources of nitrogen may be easily manipulated, by fractional application in solution, to reach an availability figure of 90% and more.

It is obvious that because of the differences in availability, the merits of mineral and organic (from manure) forms of N cannot be compared. At times organic N will prove better, at other times poorer.

A disturbing factor in the comparative evaluation of manure and mineral fertilizer is the residual effect of the manure nitrogen that does not become available the first year. In the northern parts of the humid temperate climate residual effects may show up 5 or even as much as 10 years after the manure had been applied. These effects are of less duration in the southern parts of the temperate climate and still less in the subtropics and tropics.

As to the availability of PK, manure and mineral fertilizer are comparable. The practice of reinforcing manure with superphosphate stems from the somewhat dubious premise on the low P_2O_5 content of manure and on the power of superphosphate to preserve some of the ammonia. Actually, a 10-ton application of manure (and that is not an excessive dose among those market gardeners who still have access to manure, or among dairy farmers) provides 50 pounds of P_2O_5, available and not reversible. This latter quality cannot be claimed fully even for superphosphate. In terms of P supplied by mineral fertilizer 10 tons of manure are equivalent to 500 pounds of 5-10-5, the all-purpose fertilizer grade used for field crops, pastures, and natural meadows.

It is thus becoming more and more obvious that the N from manure is the chief culprit in complicating the comparison on the relative merits of the organic and mineral sources of plant nutrients.

It may not be out of place to point out that, on the basis of their behavior in the plant-soil system, the three major mineral fertilizer elements are differentiated into two categories. The PK, which represent the first category, enter into chemical reactions with the soil mass and form new compounds and adsorption complexes, frequently becoming fixed in the soil. The N, which represents the second category, stays primarily in the soil solution, except for the small quantity of adsorbed NH_4, and is utilized by the plants primarily as nitrates. In other words, PK fertilize the soil and have to be released by the soil for plant use, whereas the N stays in solution and fertilizes the crop, not the soil. It is because of this differential behavior of PK and N that we must exercise great care with N treatments (any excess causes vegetative soft growth) and not worry about

excesses of P and K salts. Here, the advocates of organic sources of nutrients may come in with the suggestion of using organic N which reacts slower than inorganic N.[1]

On sandy soils, in regions of heavy rainfall, the use of organic N is advocated because of its insolubility, thus obviating leaching effects. Actually, the insolubility is of short duration, since the organic N is rapidly converted into inorganic forms. It is high time that the following fundamental truth should be realized by the victims of the unscrupulous propagandists of all kinds of organic concoctions and processes of composting organic materials to the exclusion of mineral fertilizer: *in nature, organic sources of nutrients added to the soil are readily converted to inorganic nutrients, whereas inorganic nutrients in the soil are used by the microbial flora and a share of the mineral nutrients is converted fairly readily into organic nutrients.*

Losses of mineral N are due to the unwarranted practices of applying large quantities of fertilizer at planting or seeding time. No germinating seeds or transplants need at that stage the 50, 100, or more pounds of N and similar quantities of other water soluble salts. Any heavy rain may wash out the bulk of nutrients soon after they have been incorporated, especially from sandy soils.

It has been shown by Tiedjens that only small quantities of mineral nutrients are necessary at planting or seeding time. By now, many farmers use the method of applying nutrients in solution whenever the plants show need for these. Under such a system losses of nutrients are reduced to a minimum and there is no point in using organic nutrients which frequently lag behind in the rate of supplying these, causing a deficiency of one or more elements.

When dry fertilizer salts are used the problem of losses of nutrients may be solved by the method of fractional application. For soils that have to be kept at a low pH or for sandy soils, banding of fertilizer (as low as 75-100 pounds per acre) is an effective expedient against the risk of losing nutrients by leaching. Soils in good physical condition will do better for most crops with 150-200 pounds of fertilizer and other soil amendments plowed under. The rest of the nutrients may be supplied by sidedressing whenever the plants show need for these.

In short, the evidence seems to be clear that from the point of view of N supply there is no justification for using organic nutrients whenever mineral sources are available. There are, however, other factors, mentioned earlier in the discussion, to be evaluated in comparing the relative merits of organic and inorganic nutrients, and these bear repetition.

Progressive farmers and scientifically trained agriculturists know that manures and other types of organic materials, such as peats, composts, artificial manure, sewage sludge, and green manures (for all of these organic sources, the barnyard manure is the standard of comparison) contribute something more, besides nutrients, to the system of soil and plant growth relationships. These accessory effects of organic sources of nutrients are by and large associated with the over-all problem of soil organic matter, one of the most befogged issues among agriculturists, including many of the so-called soil specialists. A multitude of sins has been covered up with the organic matter alibi in solving soil productivity problems.

[1] It will be recalled that as late as 1913 more than 40% of the N in mixed fertilizers was derived from organic sources: guano, tankage, fish meal, dried blood, and similar products. Now this figure is about 5%. Two causes are responsible for the decline of the organic forms of N. First, most of the source material of organic N has been diverted into feed channels and the price has gone up. Pound for pound, organic N costs two to three and more times as much as inorganic. Second, it has been shown experimentally that mineral N is just as good and for some crops even better than organic N.

To extricate oneself from the avalanche of theoretical possibilities and scholastic diatribe on soil organic matter is a task of no small magnitude. It is not easy to follow a straight path in the labyrinth of highways and byways of the so-called studies on soil organic matter. A partial solution to this difficulty presents itself by analyzing the fairly well-known functions and factors associated with organic matter in soil productivity and comparing these with those of mineral salts. Generally, the following beneficial functions and factors are credited to manures and other types of organic materials used in standard soil management operations:

1. **Supply of Principal Fertilizer Elements NPK:**—As pointed out earlier, organic and inorganic sources of PK are comparable in their availability to crops. The practice of reinforcing manure with acid phosphate is not fully justified from the point of view of supplementing P to the manure. A 300-bushel crop of potatoes requires 35 pounds P_2O_5 and a 15-ton crop of sugar beets 45 pounds P_2O_5. A 10-ton application of manure supplies at least 50 pounds of available P_2O_5. The preservation of the ammonia and the supply of sulfates as gypsum are more valid reasons for the practice of reinforcing manure with superphosphate.

The chief difficulty in comparing the organic and inorganic sources of nutrients lies not in the P, but in the N. A comparison of the merits of the two sources of N clearly shows, as pointed out earlier, the superiority of mineral N. It lends itself to more rigid controls of supply in the complex system of soil productivity. Many failures of manure have been traced by the writer to the short supply of available N. Maercker's studies on N availability have shown that negative availability may be as low as –13.8%. These results are significant, but they are not generally recognized. It should be emphasized that it is imperative to add mineral N to certain types of manures, such as fresh manure, especially from animals kept on short N rations, or manure rich in bedding of a low N content, straw, sawdust, wood shavings, or similar materials. For the comfort or discomfort of the organic farming exponents, one should state that mineral N compounds are just as much nature's products as animal manures are.[2]

In this connection one should remember that manures harbor all kinds of pathogens—bacteria, actinomycetes, fungi, and protozoa—harmful to humans and domestic animals. These pathogens are dangerous while the manure is being handled; in the soil they are killed off by the antibiotics produced there. This may be one reason why the use of night soil has not prevented the Chinese from building up a 500-million population.

2. **Supply of Accessory Elements, Micro Elements, and Hormones:**—As a rule, practically all fertilizer grades carry the accessory elements, such as Ca, Mg, and S, in much larger quantities than manure, composts, or any other type of organic material may supply. Besides, any good farmer knows the value of dolomitic limestone which incidentally carries besides the principal elements, Ca and Mg, a number of micro elements. It has been reported in literature that additions of high-grade dolomitic limestone do not cause immobilization of B.

It may not be out of place to dispel the claim for micro element supply by manure or composts. If anything, this may be more true for a green manure crop which extracts from the soil, the depository of practically all the elements in nature, not only the more frequently mentioned B, Zn, Cu, Mo, Co, but all the others. But, need we remind an informed agriculturist that the stage at which green manure is plowed under, rather than any one specific attribute—micro elements or

[2] There is frequently a difference in the odor of the two sources of N.

(*Turn to page* 44)

Fig. 1. With very little lodging, 130 bushels of oats per acre were produced here with 500 lbs. of 0-20-20 plus 100 lbs. of ammonium nitrate. Omitting the nitrogen (500 lbs. of 0-20-20 only) the yield was 59.2 bushels per acre, and with no treatment the yield was 47 bushels. (Farm of Elmer Hackbert, Rio, Wisconsin.)

The Magic of Nitrogen

By C. J. Chapman

Soils Department, University of Wisconsin, Madison, Wisconsin

NITROGEN factories, some of which were built during World War II for the production of gunpowder, are now working overtime to produce potential food for man and beast. Also, new and expanded factories with a total capacity of about 900,000 tons of fixed nitrogen have been authorized. This, added to our present annual output of about 1¼ million tons of nitrogen will make possible a tremendous increase in potential crop production in this country in the years to come.

It is my belief that one of the greatest opportunities for increased production of food and fiber lies in the increased use of nitrogen fertilizers.

Nitrogen for more grass! Nitrogen for more grain! Nitrogen for more corn! Nitrogen for more cotton! But in the same breath I also say—let's build our long-time crop production program on a solid foundation. Let's use liberal applications of lime, phosphate, and potash in a program of good crop management—with longer rotations that include more soil-improving legumes.

Feeding nitrogen fertilizer to the soil to make better feed crops for livestock is a significant new development on Wisconsin farms. To have recommended it 25 years ago would have been considered heresy by our agricultural professors of that era. In fact, this reluctant attitude was found in most states of the Midwest up to very recent years. We were completely committed to the idea that growing legumes was the one and only way of

maintaining adequate supplies of nitrogen in our soils.

The approach to this ultimate goal of adequate nitrogen for all crops on our dairy farms centered around the application of lime, phosphate—and in more recent years—potash fertilizers. Certainly, that was and still is a most commendable objective, and I subscribe to it 100 per cent. In fact, the major emphasis in my extension program of soil and crop improvement over a period of 30 years has been centered around this approach; namely, the liberal application of lime and fertilizers and the growing of abundant crops of protein-rich legumes for feed and for soil nitrogen.

But there are millions of acres in Wisconsin still producing only half a crop. That is because they are shy of nitrogen and organic matter.

This shortage has come from a mistaken notion that we could maintain nitrogen and organic matter by growing legumes alone. In Wisconsin this practice has been given a good tryout the last 18 years. Farmers have applied more than 24 million tons of lime and 4 million tons of fertilizer. For 16 years our farmers have harvested an average of better than a million acres of alfalfa; in fact, Wisconsin farmers harvested 2,182,000 acres of this protein-rich forage crop in 1951. Clover has also become more abundant and dependable, because of widespread soil treatments.

But we haven't raised the organic matter and nitrogen levels in Wisconsin by that program.

I still believe fully in lime, phosphate, and potash. I'm not talking any less about this approach to a long-time program of soil building and crop improvement. But I am talking more about making every acre produce as large a crop as it can within the limits of economy. And that means extra nitrogen.

Nitrogen for Grain

One great opportunity for profitable use of nitrogen is on small grain—particularly oats. The danger of lodging and smothering seedings of clover and alfalfa had always been my chief argument against nitrogen fertilizer on grain. Now there is less danger of lodging with the stiff-strawed oats,

Fig. 2. On the farm of Roy Schlough, Mazomanie, Wisconsin, $300 worth of ammonium nitrate increased his corn yield by 35 bushels per acre and put an extra $4,165 worth of corn in his silos and cribs. He applied this extra nitrogen at the rate of about 110 lbs. per acre. All 70 acres of corn had a "shot" of 4-20-20 in the hill at the time of planting.

such as Clinton, Bonda, Andrew, and Shelby. They will stand up on most soils, even when yields go up to 75 and 90 bushels.

Another reason we can use nitrogen on a considerable acreage of grain is that the millions of tons of lime and hundreds of thousands of tons of phosphate and potash fertilizer poured on farms the last 10 years give clover and alfalfa seedings a more vigorous start. Once well established, they are better able to compete with the heavier straw resulting from nitrogen fertilizer.

For grain on low-fertility soils, where the straw is likely to be short, I suggest a fertilizer mixture containing nitrogen. Or, a nitrogen fertilizer may be applied as a topdressing after the basic treatments with phosphorus and potash have been made.

Where soils are only moderately short on nitrogen, such mixtures as 5-20-20, 4-16-16, or 3-12-12 are suggested at 300 to 500 pounds per acre. Where straw is apt to be very short, supplement the basic application of 0-20-10, 0-20-20, or 0-10-30 with 75 to 100 pounds of ammonium nitrate, 100 to 150 pounds ammonium sulfate or cyanamid, or 150 to 200 pounds nitrate of soda. High-nitrogen mixtures such as 10-10-10 at rates up to 400 to 500 pounds per acre can also be used.

Will Boost Corn Yields

Lack of nitrogen was the bottleneck that held down yields on tens of thousands of corn acres in 1951.

In recent years nitrogen fertilizer, applied as a sidedressing to the corn crop at the time of the second or third cultivation, has produced some spectacular increases in yields. Thousands of farmers in the Midwest are now following this practice of sidedressing their corn early in the growing season.

I predict that the sidedressing of corn with nitrogen fertilizer will do more toward increasing yields of this crop than any practice that has ever been followed or recommended. More and more farmers all over the Midwest are following this practice. On fields that will make, let's say, 50 or 60 bushels of corn per acre and where in previous years such fields have been limed and commercial fertilizer has been applied at the time of seeding down, the application of 125 to 150 lbs.

Fig. 3. The application of 150 lbs. of ammonium nitrate as a sidedressing in early July boosted yields from 31.6 to 65 bushels per acre, and better feeding quality, too. Protein content is from 1 to 3% higher where extra nitrogen is applied. (Farm of Vernon Pederson, DeForest, Wisconsin.)

Fig. 4. On the Milton Beerkircher farm, five miles west of Dodgeville, Wisconsin, a June grass pasture was divided into equal halves and separated with an electric fence. The west half was topdressed on April 6 with ammonium nitrate at the rate of 200 lbs. per acre. On May 14, Mr. Beerkircher turned eight of his Holstein cows into the fertilized half. These same eight cows were subsequently rotated back and forth from fertilized to unfertilized over a period of 50 days, with the following results:

	Fertilized	*Unfertilized*
Number of pasture days (8 cows)	31	19
Pounds of milk produced	11,319	7,230
Value of Milk @ $3.89 per cwt.	$440.31	$281.25
Difference in favor of fertilized pasture		$159.06
Cost of fertilizer		$19.40
Net gain		$140.66

The use of a balanced fertilizer such as 10-10-10 is now being recommended to avoid draining these pastures of their scant reserves of phosphate and potash.

per acre of ammonium nitrate or its equivalent in other forms of nitrogen fertilizer such as ammonium sulphate or cyanamid may result in increases of 20 and even 40 bushels per acre.

Topdress Permanent Pastures

The topdressing of permanent grass pastures with 10-10-10 or other high-nitrogen fertilizer looms up as a great opportunity for low unit cost milk and meat production on Wisconsin farms. There are thousands of acres of pasture land in Wisconsin where the application of 10-10-10 at rates up to 500 lbs. per acre will be found highly profitable. The results of 213 acre scale 10-10-10 pasture plots carried out in 1951 indicate that this is true. The average acre yield calculated as dry matter for all of the 10-10-10 plots harvested was 6,156 lbs. The unfertilized yielded 2,751 lbs. This gain of 3,405 lbs. extra forage was equivalent to a 16% or 18% dairy feed which at a conservative figure of $50 per ton would amount to $85.13. The cost of 500 lbs. of 10-10-10 last spring was $18. Thus there was an average net profit of $67.13 over and above the cost of the fertilizer for all of the plots where yield data were taken.

On the horizon of potential future crop production there looms a great opportunity for increasing yields. The magic word is "nitrogen." Nitrogen for more grass, nitrogen for more grain, nitrogen for more corn! But let's also put our long-time crop program on a solid foundation. Make liberal applications of lime, phosphate, and potash in longer rotations with more legumes.

Fig. 1. New Hampshire soils respond to lime and fertilizers. On left, no fertilizer; on right, lime, phosphorus and potash, applied to clover and timothy seeding. Agawam soil, Claremont, New Hampshire.

Inventorying Soil Improvement

By Ford S. Prince

Agronomy Department, University of New Hampshire, Durham, New Hampshire

THE increased activity in rapid soil testing may make it possible to evaluate, with some degree of accuracy, the progress being made in soil improvement.

Such an inventory may be more valuable in the case of lime than of the primary fertilizer nutrients, since applications of lime appear to be more lasting than of superphosphate and potash. Perhaps it would be more accurate to say that it is easier to find it or the effects of it a few years after it is applied.

The application of lime is known to be a more or less permanent form of soil improvement. Lime is applied, for example, to a field. A similar portion is not limed. Twenty or more years later, the effects of this application can be determined by a pH test, the test showing less acidity and perhaps a higher level of available calcium than its unlimed counterpart.

We have records in New Hampshire of such a situation on land limed in 1925, a part of the field being unlimed at that time and, in fact, has not yet been limed. In 1947, this field was seeded to red clover, and careful yield records were taken in 1948 and 1949, two cuttings in 1948, one in 1949. A midsummer drought in 1949 prevented a second harvest during that year. For the 17 years prior to 1948, the land had been fertilized uniformly, although prior to that time the land had been in a fertility experiment. The various plot treat-

ments were equally distributed over the limed and unlimed portions of the field so that the fertilizer variables applied during the years 1925 to 1931 were equal so far as this lime test was concerned.

The data in Table I leave no room for doubt as to the lasting qualities of a lime application. The seeding was made 22 years after the lime was applied and the harvests were secured 23 and 24 years after its application.

TABLE I

Treatment	Total yield red clover hay 1948 and 1949
4 Tons lime, 1925.....	5.40 Tons/A.
2 Tons lime, 1925.....	4.85 Tons/A.
No lime, 1925.....	2.20 Tons/A.

The pH value of the plots in 1947 which had received four tons of lime in 1925 ranged from 5.1 to 5.43. For the plots which had been limed at the 2-ton rate, the pH values varied from 4.71 to 5.08, whereas the readings for the unlimed plots ran from pH 4.43 to 4.60. These tests were made in April 1947.

It isn't surprising that a soil with a pH of 4.5 won't grow red clover, and that was the case on the unlimed area. What did surprise us tremendously was that we grew good red clover on the plots which had been limed at the 2-ton rate more than 20 years before, even though the pH value was just around 5.0. Whether a field has been limed within the past 10 or 20 years may be of more importance than the actual pH reading.

The yields reported for the 2- and 4-ton applications were not maximum yields. Lime at the rate of 1¼ tons per acre was applied as a cross treatment during the process of land preparation and was superimposed on some of the plots which had originally received 2 and 4 tons. The yield for this newly limed series averaged 5.62 tons for the three cuttings as compared with 5.40 and 4.85 tons for the 4- and 2-ton applications, respectively.

These facts are presented here merely to indicate that liming is a method of soil improvement that is lasting. They are not intended as arguments against liming freely and pushing the pH up

Fig. 2. Ladino-timothy with lime and superphosphate plus 25 pounds K_2O per acre. Worthington soil, Colebrook, New Hampshire.

toward but not necessarily beyond the neutral point of pH 7.0.

With all the lime that has been used in New Hampshire during the past 10 or 12 years then, it is interesting to speculate upon just what changes have occurred with respect to the pH value of our soils. In 1937, we summarized the results of 1,000 soil tests which had been made in the State during the preceding 12 months. These sample tests were chosen at random from all the counties of New Hampshire.

In 1947, due to the activities of the Production and Marketing Administration in promoting the Agricultural Conservation Program, 870 samples of soil were taken in Hillsborough County, New Hampshire. These samples were taken carefully by community committeemen who had been trained for this purpose. After they were collected at the county office, the samples were then brought to the State Laboratory at the University for analysis.

A summary of the pH values of the soils from Hillsborough County as made in 1947 is given in Table II, in comparison with the tests which had been summarized in 1937. It will be noted that the pH readings run considerably higher in the 1947 samples. In point of fact, almost 60 per cent of the 1947 samples tested above pH 5.5 whereas only 41.5 per cent of the 1937 tests were at pH 5.5 or higher.

TABLE II

pH Range	Per cent of samples	
	1937	1947
6.0+	13.7	21.4
5.5–6.0	27.8	38.1
5.0–5.5	46.8	36.8
5.0–	11.7	3.7

This recent change in the pH value of our soils is further borne out by 557 tests which were made for Merrimack County farmers in 1949. In summarizing these tests, we discovered that about 25 per cent of the soils were at or above pH 6.0, while 68 per cent were above pH 5.5. These percentages compare with 21.4 and 59.5 per cent, respectively, for the Hillsborough samples taken two years previously.

It isn't surprising, of course, that the

Fig. 3. Ladino-timothy with same lime and superphosphate as in Fig. 2 but with 100 pounds K_2O per acre. Worthington soil, Colebrook, New Hampshire.

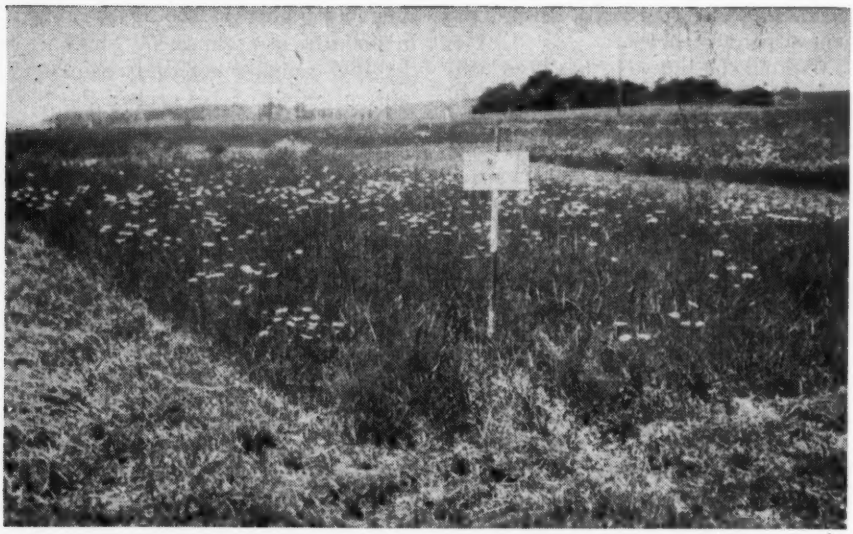


Fig. 4. Timothy and red and alsike clover were seeded on this plot without liming.

pH values of our soils in New Hampshire have changed in recent years. During the five years preceding the operations of the Agricultural Conservation Program, farmers in the State purchased only a little over 3,000 tons of lime each year. During the first five years of the ACP, lime use data jumped to slightly more than 20,000 tons per year. For the years 1937 to 1949, inclusive, more than 275,000 tons of lime were used on the soils of the State. This explains why the pH values are changing for the better, since this amount of lime doesn't fall far short of a ton of lime per acre of crop land, even though it wasn't distributed that way, of course.

As was noted at the outset, it is more difficult in our area to record improvement for applications of either phosphorus or potassium than for lime. The soils of New Hampshire have a high fixing-power for both these elements, and although they do vary some in respect to the rapidity of fixation, this process occurs fairly or very rapidly in all of them. Phosphorus is changed in the fixation process to iron or aluminum phosphates or to other similar compounds, in which cases it is less readily available to plants than it is in superphosphate. Furthermore, in this State, it does not show up readily in the rapid soil tests in the changed form.

Similar phenomena occur with potash as well. The rapidity of fixation of potassium varies more, perhaps, than with phosphorus, and depends on the type of clay minerals present. Potash fixation occurs more rapidly, it is believed, on the schist than on the granitic soils in this area.

Table III tends to bear out the foregoing statements with respect to phosphorus. Even though large quantities of superphosphate have been distributed to New Hampshire farmers during the past 15 years in which the Agricultural Conservation Program has been in operation, the changes in the test for phosphorus as noted in the Hillsborough and Merrimack County soil tests are not nearly so great as recorded in the pH values.

The tests do show a slightly higher available phosphorus level, however, there being 13.5 and 14.7 per cent of the samples above a reading of medium in the Hillsborough and Merrimack

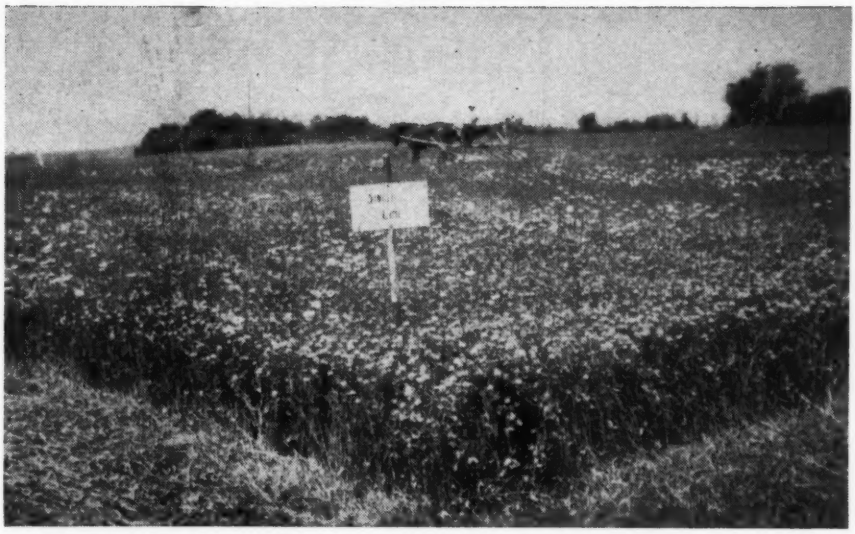


Fig. 5. Two tons of lime were applied to this plot, but it had the same fertilizer as in Fig. 4.

tests, respectively, as compared with only 6.5 per cent in the 1937 samples. There is, of course, a corresponding reduction in the percentage of samples testing at low or poorer in the two county tables.

TABLE III

PHOSPHORUS

	1937 Tests %	Hillsborough County 1947 Tests %	Merrimack County 1949 Tests %
High and very high	.6	2.0	3.2
Medium and medium high	5.9	11.5	11.5
Low	35.4	15.4	12.9
Very low and lower*	58.1	71.2	72.4

* These notations are given as stated by Dr. M. F. Morgan, Bul. 392, Conn., New Haven Expt. Station, upon whose methods these tests were based.

It is doubtful if the soil-phosphorus relationships are well understood by farmers in this region. Plants use less of the element phosphorus than of calcium and potassium, for example. Furthermore, because of the rapidity of the fixation process, this element is quickly tied up in the soil, becoming relatively less available to plants. Even so, it becomes a reserve of phosphorus for crops to use in the future, since it is not lost from the soil in the leaching process.

Because of these factors, more phosphorus than is needed by the immediate crop will always have to be applied, to insure a readily available supply. It is doubtful in New Hampshire, if more than 20 per cent of an application of phosphorus is recovered by the crop to which it is applied and this is no doubt an outside figure for most applications and crops in this area.

Keeping applied phosphates available in the soil is one of the problems encountered in Northeastern farming. As the pH level of the soils increase, the problem may diminish somewhat. The use of superphosphate in stables, incorporating the phosphorus with manure, is another method of attaining this end. Band placement for rowed crops offers still a further means of limiting the amount of soil with which the fertilizer comes in contact, and as a result less of the phosphate is immedi-

Fig. 6. Winter wheat responds to phosphorus. No phosphorus left, 80 pounds P_2O_5 on right. Agawam soil, Claremont, New Hampshire.

ately fixed. Any and all of these practices should be followed religiously by farmers to get as much use of applied phosphates as possible.

The data for potash in Table IV are somewhat more encouraging, even though they leave much to be desired. A study of this table shows that 10.4 per cent of the 1937 samples tested at medium or higher, and this percentage compares with 12.4 and 42.1 per cent for Hillsborough and Merrimack Counties, respectively.

TABLE IV

POTASH

	1937 Tests %	Hillsborough County 1947 Tests %	Merrimack County 1949 Tests %
High and very high	6.6	2.4	23.7
Medium and medium high	3.8	10.0	18.4
Low	6.0	6.7	7.9
Very low and lower	83.6	77.8	50.0

This wide divergence in the data for the Hillsborough and Merrimack County tests may be explained in part by the differences in methods of sampling. In Hillsborough County, the farms were taken at random from among those who were cooperating in the Agricultural Conservation Program, the sampling was done by Community Committeemen, and all the fields of the farms chosen were sampled whether they had been limed or fertilized or not. In Merrimack County, a campaign was staged to get farmers to have their soils tested, and as a rule, it is the better farmers, or farmers who on the average would use more fertilizer, who cooperate in such an effort.

With this in mind, it can readily be understood why more than 40 per cent of the Merrimack County samples tested above the "medium" reading for potash, whereas only 12.4 per cent of the Hillsborough samples tested as high as that.

The data show, also, that it is easier to find available potash than phosphorus in the soil by testing after it is applied. This means, obviously, that potash does hold its availability longer in the soil than phosphorus. At least, this is true in these New England soils.

Another point that could have some

(*Turn to page* 39)

Master Cotton Farmer Shelby County, Alabama

By Bill Nichols

Sylacauga, Alabama

"TWO things I always figure necessary to make a good yield of cotton—first, you have to have a good stand on the ground, and then you have to put down plenty of fertilizer to make it fruit up heavy."

The speaker was Defford Morris, champion cotton grower of the Harpersville Community in Shelby County, Alabama. His words of advice paid off, because in the 1951 crop year his 75-acre block of cotton produced 120 bales. Parts of the field grew more than two bales per acre, and County Agent A. A. Lauderdale estimates that at least 30 more bales were lost due to extremely dry weather in August and September.

Defford is one of the younger farmers of Shelby County. Up until three years ago he was operating the local garage in Harpersville. His neighbors will tell you that he was the best mechanic for miles around, and these same neighbors now look to him for advice in growing cotton.

You need only to drive through this community to know that it is predominantly a cotton community. The Wyatts, Bakers, Kidds, and "Big Mac" McCall all grow large acreages of cotton with yields averaging three-fourths to one bale per acre. Most of these good cotton farmers try to get their crops in by April 20. They use ample fertilizer, plant delinted and treated seed, and do not hesitate to poison when necessary. But the man who is the "professor" is Defford Morris. He estimates that more than 1,000 farmers from Shelby and adjoining counties inspected his fields last season.

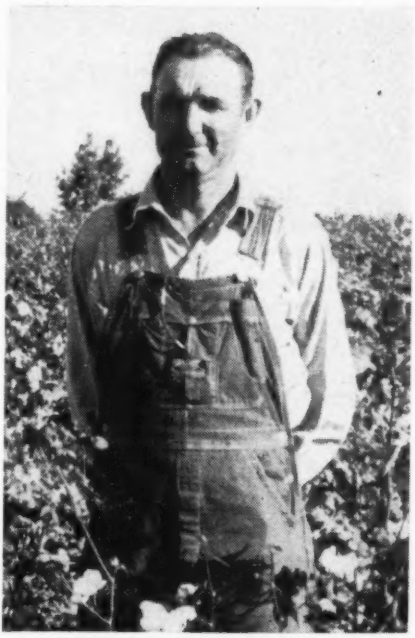


Fig. 1. Defford Morris, Shelby County Master Cotton Farmer.

What is the secret of producing a bale and a half per acre on an entire crop? We believe Defford Morris has found part of the answer to this question in his planting operations, but to get the entire story of this record yield, we must go back to the fall of 1950, when he gathered 76 bales from 56 acres. Cotton growers will remember 1950 as a severe boll-weevil year. "I had to fight the weevils every week, and we poisoned with 3-5-40 right on up to picking time," says Mr. Morris, who poisoned 16 times to produce this bale and a half to the acre crop.

Fig. 2. Mr. Morris explains to a group of neighboring farmers how he made this fine crop. Cotton had received first picking when this picture was made.

After picking, he cut the stalks and planted vetch in the middles around the first of November. The winter of 1950 was quite severe and most cover crops were killed by the 6° weather on Thanksgiving day. This land was turned on December 15, disced twice, and harrowed down perfectly smooth before planting. "Slick" or acid-delinted seed were planted on April 15. These seed were hill-dropped in a peculiar manner. Defford had reasoned out that to produce big yields, there must be plenty of stalks on the ground, and he had previously tried thick spacing in the drill with fair results. Using his natural ability as a mechanic, he took a four-hole soybean planter plate and reamed out the openings from the under side. The result gave an inverted funnel effect and allowed some 6 to 8 seed to fall to the hill. "I didn't put a hoe in the crop except to get out the grass after the first plowing," he says, "and I believe every seed came up to a perfect stand."

The hills were spaced 24 inches apart in 40-inch rows, giving a planting population of from 40,000 to 53,000 per acre.

It goes without saying that reports got around fast to the farmers in the Harpersville Community about this field of cotton. Most of us were skeptical as to whether the cotton would make, planted this thick. The hills presented a bushy appearance, with the fruiting limbs spread out toward the middles and with very few squares in the center of the individual hills. To quote a visiting farmer who had come from Sand Mountain to see this fine crop: "It was the prettiest field of cotton I ever saw. It looked like Mr. Morris had set a flower pot of cotton plants every two feet in the rows. The color was dark green and showed it had plenty of plant food."

This Sand Mountain farmer was right, because Defford had used 500 pounds of 4-10-7 under each of the 75 acres. His neighbors liked to kid him by telling that he sidedressed every time he plowed the crop, but there were only two sidedressings. The first was put down when the cotton was 30 days old and consisted of 200 pounds of 4-10-7 and 100 pounds of ammonium nitrate (33% nitrogen). The second application of fertilizer

(*Turn to page* 47)

Pastures Pay Profits In Louisiana

By Fred J. Hurst

Farm Credit Administration of New Orleans, New Orleans, Louisiana

THE increasingly important role of pastures in Southern agriculture has been impressively demonstrated by the Louisiana experiment stations which are located on different soil types. Productive pastures have been established and high net returns obtained on lands unsuited for cultivated crops. A brief summary of the work done by the various stations throughout the State will indicate the possibilities of pastures as a means of increasing the production of meat and milk for consumers and increased cash income for farmers.

The Southeast Louisiana Livestock and Dairy Experiment Station near Franklinton is located on hilly, cutover, sandy land that cost $6 per acre. Part of this land was limed, fertilized, and seeded to winter-grazing crops, including oats alone, oats and southern winter peas, oats and crimson clover, and rye grass and crimson clover. Dairy cows were grazed from December 16 to May 18, or a period of 136 days. This grazing produced 3,550 pounds of milk per acre. The milk was sold for $6.54 per hundred pounds and brought $155 per acre above all feed costs. It brought $107.50 per acre net above all feed costs and all pasture costs except depreciation on machinery.

The dairy herd was shifted to permanent pasture of Dallis grass, white Dutch clover, and common lespedeza on May 19 and grazed until Novem-

Fig. 1. Lush growth of Dallis grass and Louisiana white Dutch clover at the Red River Valley Station near Shreveport.

ber 30, 1949, a period of 196 days. These cows produced 3,331 pounds of milk per acre during this period. The milk was sold for $5.67 per hundred pounds and brought $122.86 per acre above all feed costs.

Cows grazed on sweet Sudan from July 21 to September 7, a period of 46 days, produced 1,407 pounds of milk per acre worth $56.34 per acre above feed costs.

Land for winter-grazing crops was fertilized with 500 pounds of 6-8-8 per acre before seeding and topdressed with 40 pounds of nitrogen per acre on January 23 and March 1.

Oats were seeded at the rate of 3½ bushels per acre; southern winter peas, 35 pounds per acre; rye grass, 30 pounds per acre; crimson clover, 25 pounds per acre. Oats, peas, and rye grass were planted September 29-30 and crimson clover was overseeded on oats and rye grass on October 25 after danger of the hot sun killing the young seedlings was passed.

Land established in permanent pasture was thoroughly prepared. Two and one-half to three tons of dolomitic limestone, 500 pounds of 20% superphosphate, 100 pounds of 50% potash, and 100 pounds of ammonium nitrate were broadcast and disked in. The pasture was then seeded to 20 pounds Dallis grass and 12 pounds common lespedeza per acre in March. White clover was seeded on the grass sod in October at the rate of eight pounds per acre.

This station has found Alyce clover to be the best hay crop for this sandy land section. It has produced 2 to 2½ tons of leafy, high-quality hay per acre. The clover was seeded about the middle of June after oats were combined. It was fertilized with 350 pounds of 3-12-12 per acre and the seed sowed broadcast. The clover makes a quick, rapid growth and is free of weeds.

The station at Calhoun, which is also located on hilly, sandy land has demonstrated the possibilities of reseeding crimson clover as a winter-grazing crop. A steep, sandy hill which was seeded to crimson clover, limed, and fertilized with 300 pounds of 3-12-12 per acre and grazed for a period of seven weeks in February, March, and April produced 388 pounds of beef per acre.

Alfalfa also has given excellent results at Calhoun, where it has been planted on well-drained, Orangeburg soil, limed and fertilized. Alfalfa has given good grazing in the fall, winter, and spring and a hay crop in the summer.

At the North Louisiana Hill Farm Station near Homer, remarkable results have been obtained from crimson clover alone and oats alone, oats and southern winter peas, and oats and crimson clover. These crops produced heavy grazing throughout the winter and early spring and after the cattle were removed to permanent pastures in April produced a good crop of hay which was harvested about the middle of May.

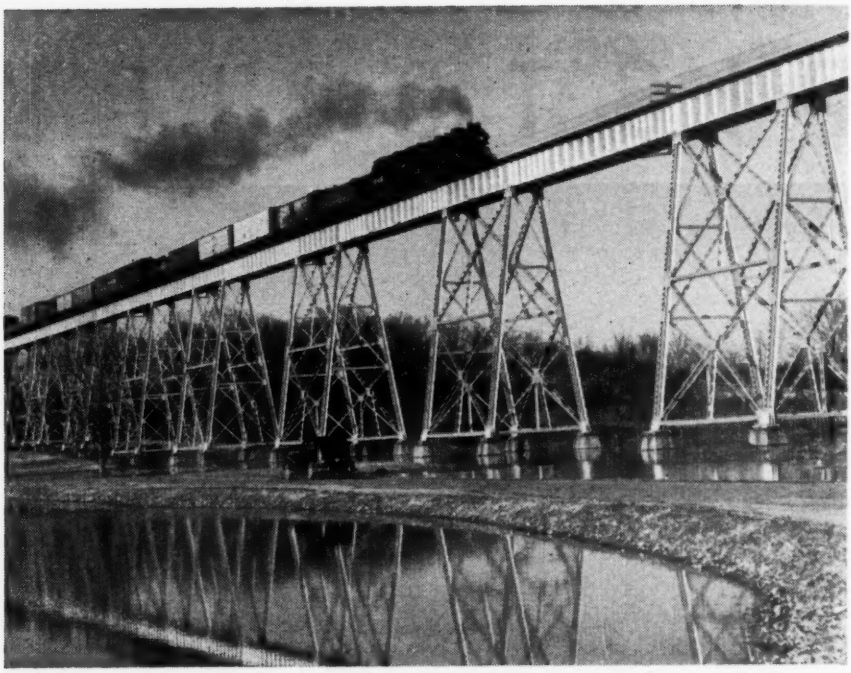
On May 10 Brown Swiss and Red Sindhi Brahman crossbred calves were still grazing lush crimson clover. The clover carried three calves per acre. They had no other feed but they had made rapid growth and were in excellent condition. The crimson clover was overseeded to common lespedeza in early March. The lespedeza provided plenty of grazing for the calves throughout the summer and early fall months. The crimson clover had one ton of lime and 400 pounds of 3-12-12 per acre applied and disked into the soil before seeding in October.

Winter-grazing crops had one ton of lime, 34 pounds of nitrogen, 100 pounds of superphosphate, and 60 pounds of potash per acre applied before seeding. The permanent pastures were sodded to Bermuda grass, Dallis grass, crimson clover, white clover, hop clover, and lespedeza. They were fertilized with 400 pounds of 3-12-12 per acre.

(*Turn to page* 42)

PICTORIAL

The Matriarch



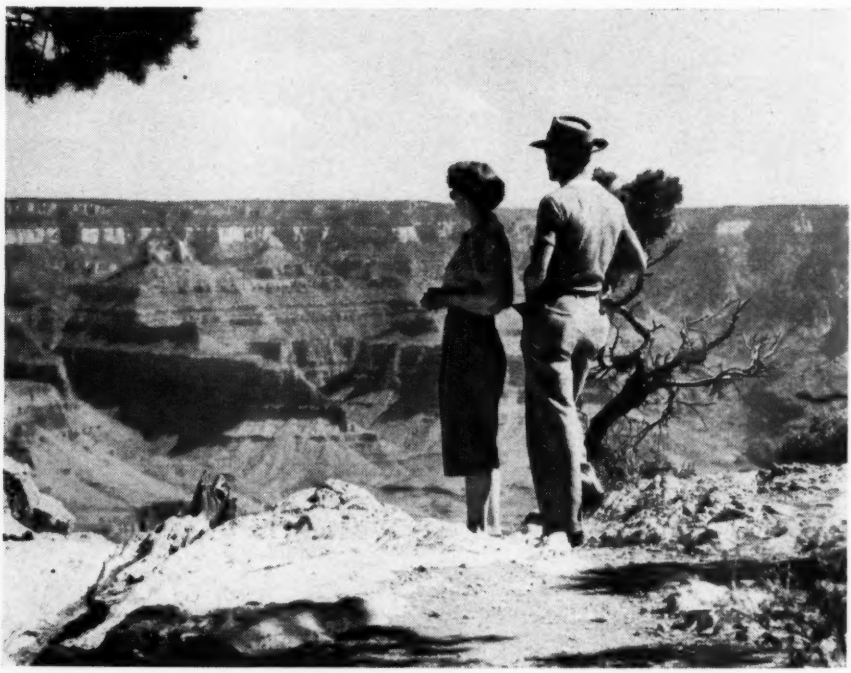
Above: **Last year's crop still going to market.**

Below: **This year's crop going into the ground.**

Above: **Cutting asparagus, a crop of early harvest.**

Below: **Spring plowing with snow in the background.**

Gullies



The Editors Talk

Fertilizer Placement

An experimental placement machine, recently developed jointly by agricultural engineers of the U. S. Department of Agriculture and the North Carolina Agricultural Experiment Station, is being used to gather fertilizer placement information for guidance of farmers in the Southeastern States. This versatile machine accurately places one, two, or three bands of fertilizer on one or both sides of a seed row at various distances, such as 3, 9, and 15 inches, and at depths ranging from 3 to 5 inches. It also will place fertilizer directly with the seed during planting, and it will mix fertilizer in a 6-inch wide, 3-inch deep soil zone down the row. The machine has been successfully used in tests with small grains, corn, cotton, and tobacco. It will be used in further experiments with vegetables, soybeans, and peanuts.

This is an age of mechanization, and this is another example of the use of mechanization to speed up research and provide scientists with results upon which to make recommendations. During the past 20 years more than 40 experimental fertilizer placement machines, each one of distinctive design, have been developed. They have been used by the engineers in cooperation with soil and plant scientists in nearly 800 fertilizer placement experiments conducted with 41 crops in more than half of the States.

The tremendous increase in food and fiber production in the United States that these machines have helped to achieve is indicated in 20 per cent and higher yields obtained experimentally with corn, cotton, potatoes, and tobacco gained by precise placement rather than broadcasting of fertilizer. In 12 typical experiments with different vegetable crops in western Washington, localized side placement of fertilizer, as compared with broadcast applications, increased yields an average of 47 per cent. These machines not only have given scientists the means by which they can determine how best to use fertilizers with different crops, but they also have led to the development of superior designs for commercial fertilizer application equipment now serving the American farmer.

"IN general, soil tests help to estimate the *supply status,* tissue tests help to indicate the *first limiting nutritional factor,* and deficiency symptoms indicate *extreme and damaging shortages* in the plant. These are all practical diagnostic aids that no fertilizer research person or extension fruit, vegetable, or crops specialist, or properly trained person interested in better fertilization can afford to omit. Our agricultural colleges could render a valuable service by training students in these diagnostic procedures." . . . *Dr. George D. Scarseth, Director of Research, American Farm Research Foundation.*

Unnecessary Liming

Farmers often relime before more lime is needed, believes C. M. Linsley, Professor of Soils, Illinois College of Agriculture. Perhaps a man applies four tons of limestone to the acre but his legume seeding doesn't catch, and so he figures the soil is still acid and applies four tons more. But a soil test of this land may show a lack of phosphorus and potash. It is too low in these plant foods to grow good crops of legumes. That, and not lack of lime, is the reason for the poor stands.

Linsley points out that the $12 to $14 an acre spent for more limestone would buy a lot of phosphorus and potash and would go a long way toward better stands of legumes. "Test, don't guess. It pays off," he says.

This is good advice and, with the increasing number of soil-testing laboratories throughout all sections of the country, farmers should pay heed to it. In these days of high farm costs, it becomes doubly important that every expenditure be put to the most efficient use.

Our Cover Picture

Our cover illustration this month is from California and shows leaves and fruit of the French prune. A normal leaf appears on the left of the lower row of leaves, and the others depict symptoms of potash deficiency. These symptoms occurred on prune trees in the Santa Clara and Sacramento Valleys of California. Leaf symptoms may appear when the level of potassium in the leaves in July is 1.0% or less. The leaves shown are severely affected and actually had a content of only 0.27% potassium. The leaves of healthy prune trees have 1.5% or more potassium when sampled in July.

The fruit in the lower row is from a tree severely affected by potash deficiency. It is reduced in size and shows a premature reddening. The larger fruit in the upper row is from an adjacent tree treated with potash. The leaves of this tree had increased their level of potassium to 1.57%. The photographs were made in early August.

Prunes have been grown in California for many years. In 1950 there were 110,479 acres in this fruit, and the production was 149,000 tons of dried prunes. Since 1945 there has been a reduction of 29,500 acres in prune acreage in the State. However, 1951 production seems to show that tonnage is holding up very well, as the crop figure is 180,000 tons of dried prunes for this year. The crop is valued at $29,880,000.

One of the earliest known cases of potash deficiency in California was identified on prune trees in the Sacramento Valley. This was a subject for study by agricultural research workers in the early 20's. In the early 30's the symptoms were noted and confirmed in the Santa Clara Valley, although probably existent long before this. Prune growers have long been troubled by a condition which they called "sunburn" and "die-back," and in most cases this undoubtedly was potash deficiency.

The prune has a high requirement for potash compared to many other tree crops. Under conditions of a heavy fruit set and a low supply of potash, entire trees may die in one season. This has been a common occurrence in the Sacramento Valley. On the other hand, in the Santa Clara Valley where fruit set is much less, a deficiency of potassium causes a stunted tree condition. Leaf scorch and twig die-back occur each year, but the tree may linger for years in this unproductive condition.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay [1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1926.....	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927.....	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928.....	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929.....	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930.....	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931.....	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932.....	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933.....	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934.....	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935.....	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936.....	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937.....	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938.....	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939.....	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940.....	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941.....	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942.....	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943.....	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944.....	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945.....	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946.....	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947.....	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948.....	30.4	48.2	155.0	222.0	129.0	200.0	18.45	67.20	....
1949.....	28.6	45.9	128.0	214.0	124.0	188.0	16.50	43.40	....
1950.....	40.1	51.6	91.6	173.0	153.0	200.0	16.70	86.50	....
1951									
March.....	42.73	26.6	107.0	207.0	160.0	212.0	18.35	103.00	....
April.....	43.17	25.3	112.0	203.0	162.0	214.0	18.35	103.00	....
May.....	42.45	39.8	109.0	209.0	164.0	211.0	18.15	101.00	....
June.....	42.02	49.0	108.0	210.0	162.0	208.0	16.85	95.60	....
July.....	39.11	49.5	118.0	219.0	163.0	205.0	15.45	78.00	....
August.....	34.60	47.7	117.0	273.0	165.0	205.0	15.65	69.10	....
September...	33.73	52.4	123.0	287.0	165.0	207.0	16.55	66.10	....
October.....	36.21	57.7	139.0	271.0	164.0	210.0	17.15	69.90	....
November....	41.00	50.0	174.0	280.0	162.0	219.0	18.35	72.70	....
December....	40.34	51.0	193.0	305.0	169.0	222.0	19.65	71.50	....
1952									
January.....	38.70	46.2	207.0	347.0	168.0	220.0	20.75	70.10	....
February....	37.25	33.8	205.0	357.0	166.0	218.0	20.65	67.10	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1926.....	101	179	189	134	116	138	112	98	139
1927.....	163	207	146	124	132	135	87	154	127
1928.....	145	200	76	134	131	113	95	152	154
1929.....	135	183	189	133	124	117	92	137	137
1930.....	77	128	131	123	93	76	93	98	129
1931.....	46	82	66	83	50	44	73	40	115
1932.....	52	105	55	62	50	43	52	46	102
1933.....	82	130	118	79	81	84	68	57	91
1934.....	100	213	64	91	127	96	111	146	95
1935.....	90	184	85	80	102	94	63	135	119
1936.....	100	236	164	106	163	116	94	148	104
1937.....	68	204	76	89	81	109	74	87	110
1938.....	69	196	80	79	76	64	57	97	88
1939.....	73	154	100	84	88	78	67	94	91
1940.....	80	160	78	97	96	77	64	96	111
1941.....	137	264	116	105	117	107	82	211	129
1942.....	153	369	168	134	143	124	91	202	163
1943.....	160	405	188	235	174	154	125	231	245
1944.....	167	420	214	216	170	160	139	234	212
1945.....	181	366	205	232	198	170	127	227	207
1946.....	263	382	178	248	212	209	141	319	182
1947.....	257	380	232	248	336	259	148	381	226
1948	245	482	222	253	201	226	155	298	214
1949.....	231	459	184	244	193	213	139	192	201
1950.....	323	516	131	197	238	226	141	384	185
1951									
March.....	345	266	154	236	249	240	155	457	265
April.....	348	253	161	231	252	242	155	457	225
May.....	342	398	156	238	255	239	153	448	239
June.....	339	490	155	239	252	235	142	424	189
July.....	315	495	169	249	254	232	130	346	204
August.....	279	477	168	311	257	232	132	306	181
September...	272	524	176	327	257	234	139	293	161
October.....	292	577	188	309	255	238	144	310	171
November...	331	500	250	319	252	248	155	322	249
December....	325	510	277	347	263	251	166	317	331
1952									
January.....	312	462	297	395	262	249	175	311	337
February.....	300	338	294	407	259	247	174	298	217

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
1950	3.00	1.95	11.01	11.70	10.21	9.36
1951						
March	3.13	1.88	13.56	11.41	11.53	11.53
April	3.13	1.88	13.61	11.50	11.17	11.35
May	3.13	1.88	13.84	10.41	10.09	10.25
June	3.13	1.88	13.53	9.98	8.87	8.50
July	3.13	2.03	12.37	10.06	8.68	8.56
August	3.13	2.07	11.94	10.41	8.66	8.66
September	3.13	2.07	11.50	10.78	9.26	9.26
October	3.13	2.07	12.85	11.28	10.56	10.32
November	3.34	2.07	13.93	11.28	10.39	10.25
December	3.34	2.07	14.27	11.28	10.08	10.02
1952						
January	3.34	2.07	14.27	11.28	10.39	12.16
February	3.34	2.07	14.27	11.28	11.61	11.08
Index Numbers (1910-14 = 100)						
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
1950	112	68	315	331	303	266
1951						
March	117	66	388	323	342	328
April	117	66	389	326	331	322
May	117	66	395	295	299	291
June	117	66	387	283	263	241
July	117	71	353	285	258	243
August	117	73	341	295	257	246
September	117	73	329	305	275	263
October	117	73	365	320	313	293
November	125	73	398	320	308	291
December	125	73	408	320	299	285
1952						
January	122	73	408	320	308	345
February	125	73	408	320	344	315

Wholesale Prices of Phosphates and Potash * *

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
1950	.763	3.83	5.47	.371	.716	14.33	.195
1951							
March	.810	3.98	5.47	.420	.796	16.00	.210
April	.810	3.98	5.47	.420	.796	16.00	.210
May	.810	3.98	5.47	.420	.796	16.00	.210
June	.810	3.98	5.47	.355	.708	13.44	.176
July	.810	3.98	5.47	.389	.768	14.72	.193
August	.810	3.98	5.47	.389	.768	14.72	.193
September	.810	3.98	5.47	.386	.768	14.72	.193
October	.820	3.98	5.47	.386	.768	14.72	.193
November	.820	3.98	5.47	.386	.768	14.72	.193
December	.820	3.98	5.47	.420	.827	16.00	.210
1952							
January	.820	3.98	5.47	.420	.827	16.00	.210
February	.820	3.98	5.47	.420	.827	16.00	.210
Index Numbers (1910-14 = 100)							
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
1950	142	106	112	68	75	59	83
1951							
March	151	110	112	75	84	66	85
April	151	110	112	75	84	66	85
May	151	110	112	75	84	66	85
June	151	110	112	65	74	56	80
July	151	110	112	70	81	61	82
August	151	110	112	70	81	61	82
September	151	110	112	70	81	61	82
October	153	110	112	70	81	61	82
November	153	110	112	70	81	61	82
December	153	110	112	75	87	66	85
1952							
January	153	110	112	75	87	66	85
February	153	110	112	75	87	66	85

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1926	146	150	146	119	94	135	112	86
1927	141	148	139	116	89	150	100	94
1928	149	152	141	121	87	177	108	97
1929	148	150	139	114	79	146	114	97
1930	125	140	126	105	72	131	101	99
1931	87	119	107	83	62	83	90	99
1932	65	102	95	71	46	48	85	99
1933	70	104	96	70	45	71	81	95
1934	90	118	109	72	47	90	91	72
1935	109	123	117	70	45	97	92	63
1936	114	123	118	73	47	107	89	69
1937	122	130	126	81	50	129	95	75
1938	97	122	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	123	130	127	86	56	130	102	77
1942	158	149	144	93	57	161	112	77
1943	192	165	151	94	57	160	117	77
1944	196	174	152	96	57	174	120	76
1945	206	180	154	97	57	175	121	76
1946	234	197	177	107	62	240	125	75
1947	275	231	222	130	74	362	139	72
1948	285	250	241	134	89	314	143	70
1949	249	240	226	137	99	319	144	70
1950	256	246	236	132	89	314	142	72
1951								
March	311	272	269	142	91	357	151	78
April	309	273	268	141	91	353	151	78
May	305	272	266	139	91	334	151	78
June	301	272	265	134	91	311	151	69
July	294	271	261	135	93	297	151	74
August	292	271	258	135	94	294	151	74
September	291	271	258	135	94	300	151	73
October	296	272	259	140	94	335	153	73
November	301	274	259	143	98	343	153	73
December	305	273	258	144	98	342	153	78
1952								
January	300	275	258	144	98	347	153	78
February	289	276	255	146	98	365	153	78

* U. S. D. A. figures, revised January 1950. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] **Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.**

[2] **All potash salts now quoted F.O.B. mines only; manure salts since June 1941, other carriers since June 1947.**

** **The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. The maximum discount is now 16%. Applied to muriate of potash, a price slightly above $.353 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Fertilize for 100 Bushels (Corn)," Agr. Ext. Serv., Univ. of Del., Newark, Del., Ext. Fldr. No. 27, Feb. 1952.

"Analyses of Official Samples of Fertilizer Collected During the Fall of 1951," Kans. State Board of Agr., Control Div., Topeka, Kans.

"Analyses of Official Fertilizer Samples, Semi-Annual Report, January-June, 1951," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Reg. Bul. 93, Aug. 1951.

"1952 Crop and Fertilizer Recommendations for Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 162, Nov. 1951.

"Fertilizer Experiments with Oats and Spring Wheat in Nebraska 1951," Dept. of Agron., Univ. of Neb., Lincoln, Neb., Outstate Testing Cir. 19, Dec. 1951, G. W. Lowrey, R. A. Olson, and A. F. Dreier.

"North Carolina Fertilizer and Fertilizer Materials Tonnage Report for the Fiscal Year 1951-1952 through December," N. C. Dept. of Agr., Raleigh, N. C., Jan. 31, 1952.

"Commercial Feeds, Commercial Fertilizers, Economic Poisons, Livestock Medicines," State Laboratories Commission, Bismarck, N. D., Bul. No. 94, July 1951.

"Fertilizing Sugar Beets," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Bul. 309, Dec. 1951, W. L. Quayle, L. H. Paules, and T. J. Dunnewald.

Soils

"Soil Organic Matter," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 240, Nov. 1951, W. H. Fuller.

"Our Soil—A Basic Natural Resource," Agr. Exp. Sta., Univ. of Conn., New Haven, Conn., Spec. Bul. Soils I/500, Jan. 30, 1952, C. L. W. Swanson.

"Sweet Potato Hotbeds for Louisiana," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Bul. 453, May 1951, W. D. Poole.

"Preparation of Sweet Potato Seedbeds," Ext. Serv., Univ. of Md., College Park, Md., Fact Sheet 7, Feb. 1951, W. F. Jeffers and L. E. Scott.

"Irrigation for Truck Crops," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 163, Nov. 1951, J. A. Campbell.

"Strip Mined Lands of the Western Interior Coal Province," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Res. Bul. 475, May 1951, N. F. Rogers.

"Irrigated Farm Development in Buffalo Rapids and Kinsey, Montana," Agr. Exp. Sta., Mont. State College, Bozeman, Mont., Cir. 195, Oct. 1951, C. E. Stewart and D. C. Myrick.

"Control and Use of Resources in the Development of Irrigated Farms, Buffalo Rapids and Kinsey, Montana," Agr. Exp. Sta.. Mont. State College, Bozeman, Mont., Bul. 476, Oct. 1951, C. E. Stewart and D. C. Myrick.

"More Lime on Your Land," Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 822, Aug. 1951.

"Development of Irrigated Farms on the Mirage Flats Project," Agr. Exp. Sta., S. D. State College, Brookings, S. D., Bul. 410, June 1951.

"Report of the Chief of the Soil Conservation Service 1951," USDA, Wash., D. C.

"Raindrops and Erosion," USDA, Wash., D. C., Cir. No. 895, Sept. 1951, H. H. Bennett, F. G. Bell, and B. D. Robinson.

"Reconnaissance Soil Survey of Liberia," Office of Foreign Agr. Relations, USDA, Wash., D. C., Agr. Info. Bul. No. 66, June 1951, W. E. Reed.

"Conservation and Use of Agricultural Land Resources," Pro. and Mktg. Admin., USDA, Wash., D. C., Jan. 1952.

Crops

"Slash and Loblolly Pine Plantations in Alabama's Piedmont Region," Agr. Exp. Sta., Ala. Poly. Inst., Auburn, Ala., Cir. No. 99, March 1951, J. F. Goggans.

"Suggestions for Planting Slash and Loblolly Pine in Alabama's Piedmont," Agr. Exp. Sta., Ala. Poly. Inst., Auburn, Ala., Leaf. No. 29, Feb. 1951, J. F. Goggons.

"Desert Agriculture," Ext. Serv., Univ. of Calif., Berkeley, Calif., Cir. 176, June 1951, N. L. McFarlane and G. L. Winright.

"Horticultural Experiment Station Report for 1949 and 1950," Hort. Exp. Sta., Vineland Station, Ontario, Canada.

"Apple Harvesting and Storage in British Columbia," Dept. of Agr., Ottawa, Canada, Pub. 724, June 1951, D. V. Fisher and S. W. Porritt.

"House Plants," Dept. of Agr., Ottawa, Canada, Pub. 798, Nov. 1951, W. Godfrey.

"Planting Trees and Hardwood Cuttings on the Canadian Prairies," Exp. Farms Serv., Dept. of Agr., Ottawa, Canada, Pub. No. 864, Nov. 1951, J. Walker.

"Brome Grass Seed Production in Western Canada," Dept. of Agr., Ottawa, Canada, Pub. No. 866, Dec. 1951, R. P. Knowles, H. A. Friesen, and D. A. Cooke.

"Alfalfa, Harvesting and Feeding," Agr. Exp. Sta., Colo. A & M College, Fort Collins, Colo., Bul. 417-A, Aug. 1951, H. G. Sitler, W. E. Connell, R. T. Burdick, and S. S. Wheeler.

"Grass Pastures in Central Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 484, Nov. 1951, E. M. Hodges, D. W. Jones, and W. G. Kirk.

"Composition of Florida-Grown Vegetables III. Effects of Location, Season, Fertilizer Level and Soil Moisture on the Mineral Composition of Cabbage, Beans, Collards, Broccoli and Carrots," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 488, Dec. 1951, B. E. Janes.

"Corn Performance Tests in the Coastal Plain," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper No. 77, Jan. 1952.

"Comparison of Some New Varieties of Sweet Potatoes," Agr. Exp. Sta., Univ. of Ga., Experiment, Ga., Press Bul. 632, Nov. 26, 1951, A. H. Dempsey and B. B. Brantley.

"Summary of the Corn Performance Tests in the Mountains, Limestone Valley, and in the Piedmont Region," Agr. Exp. Sta., Univ. of Ga., Experiment, Ga., Press Bul. 633, Jan. 23, 1952, G. A. Lebedeff, M. B. Parker, J. Thompson, and G. Kozelnicky.

"Winter Wheat for Pasture in Kansas," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Bul. 345, June 1951, A. F. Swanson and K. Anderson.

"Alfalfa in Kansas," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Bul. 346, June 1951, C. O. Grandfield.

"Grain and Forage Sorghums for Kansas," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Bul. 349, June 1951, A. F. Swanson and H. H. Laude.

"Growing Bush Fruits in Kansas," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Cir. 275, Aug. 1951, G. A. Filinger.

"Variety Tests of Wheat, Oats, Barley, and Corn in the Pennyroyal Area of Kentucky 1946-50," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 569, June 1951, L. M. Josephson and D. A. Reid.

"Roses for the Yard," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Bul. No. 451, June 1951, R. H. Hanchey and W. D. Kimbrough.

"Research on Maine Farm Problems, Sixty-Seventh Annual Report of Progress Year Ending June 30, 1951," Agr. Exp. Sta., Univ. of Me., Orono, Me., Bul. 491, June 1951.

"Producing Good Tobacco Plants," Ext. Serv., Univ. of Md., College Park, Md., Fact Sheet 6, Feb. 1951, O. E. Street.

"Extension at Work," Ext. Serv., Miss. State College, State College, Miss., A. R. 1950, Pub. 182 (2M), Apr. 1951.

"Nebraska Outstate Varietal Tests of Fall-Sown Small Grains 1951, Winter Wheat—Winter Barley—Rye," Agr. Exp. Sta., Univ. of Neb., Lincoln, Neb., Outstate Testing Cir. 15, Aug. 1951, A. F. Dreier and P. L. Ehlers.

"Nebraska Corn Performance Tests," Agr. Exp. Sta., Univ. of Neb., Lincoln, Neb., Outstate Testing Cir. 18, Dec. 1951, A. F. Dreier, J. H. Lonnquist, D. P. McGill, and P. L. Ehlers.

"Carotene, Protein, Phosphorus in Grasses of Western North Dakota," Agr. Exp. Sta., N. D. State College, Fargo, N. D., Bul. 370, June 1951, W. C. Whitman, D. W. Bolin, E. W. Klosterman, H. J. Klostermann, K. D. Ford, L. Moomaw, D. G. Hoag, and M. L. Buchannan.

"Agricultural Progress through Research," Agr. Exp. Sta., N. D. State College, Fargo, N. D., Sta. Bul. 371, Jan. 1952.

"Vetch—Soil Improvement, Seed Production, Winter Cover, Pasture," Ext. Div., Okla. A & M College, Stillwater, Okla.

"Wheat Varieties Commercially Important in the Hard Red Winter Wheat Area," Ext. Div., Okla. A & M College, Stillwater, Okla.

"Forest Trees for Farm Planting," Oreg. State Board of Forestry, Salem, Oreg., Bul. No. 13, Sept., 1950, L. F. Cronemiller, H. G. Lyon, Jr., C. H. Ladd, and V. E. McDaniel.

"Planning the New Citrus Orchard in the Lower Rio Grande Valley," Agr. Exp. Sta., Tex. A & M College, College Station, Tex., Bul. 741, Oct. 1951.

"Handbook of Peanut Production in Texas," Ext. Serv., Tex. A & M College, College Station, Tex., MS-883, Jan. 1950, E. B. Reynolds, B. C. Langley, and E. A. Miller.

"Establishing a Coastal Bermudagrass Nursery," Ext. Serv., Tex. A & M College, College Station, Tex., MS-885, March 1951, A. W. Crain.

"Blueberry Propagation," Western Wash. Exp. Sta., State College of Wash., Puyallup, Wash., Sta. Cir. No. 124, March 1951, C. D. Schwartze and A. S. Myhre.

"Hybrid Corn—Adaptation Trials 1947-50," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Bul. 306, June 1951, W. A. Riedl, C. M. Rincker, and W. L. Quayle.

"Trees—Wyoming's 25-year Record," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Cir. 46, Sept. 1951, W. L. Quayle.

"Potato Growing in the Western States," USDA, Wash., D. C., Farmer's Bul. No. 2034, Nov. 1951, W. C. Edmundson, L. A. Schaal, and B. J. Landis.

"Report of the Chief of the Bureau of Plant Industry, Soils, and Agricultural Engineering, Agr. Research Admin. 1951," USDA, Washington, D. C.

"Shrub Plantings for Soil Conservation and Wildlife Cover in the Northeast," USDA, Wash., D. C., Cir. No. 887, Nov. 1951, F. C. Edminster and R. M. May.

"Suburban and Farm Vegetable Gardens," USDA, Wash., D. C., Home and Garden Series 9, Nov. 1951, J. H. Beattie and R. E. Wester.

Economics

"Arizona Agriculture 1952," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 242, Jan. 1952, G. W. Barr and R. E. Seltzer.

"Crop, Livestock and Marketing Review for 1950," Dept. of Farms and Mkts., Hartford, Conn., Bul. No. 119, Dec. 1951.

"Connecticut Vegetable Acreages 1949-1950-1951," Dept. of Farms and Mkts., Hartford, Conn., Bul. No. 120, Dec. 1951.

"Allocation of Farm Resources for Economic Production of Pasture Forage," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 568, June 1951, E. J. Nesius.

"Fruit Marketing Prospects for 1952," Ext. Serv., Univ. of Md., College Park, Md., Misc. Pub. #2D (Revised), Jan. 1952, R. L. Childress and C. W. Porter.

"Farming as an Occupation," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 360, May 1951, M. F. Miller.

"Oklahoma's Farm Population," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Bul. No. B-379, Feb. 1952, O. D. Duncan.

"Farmer's 1951 Income Tax," Ext. Serv., Va. Poly. Inst., Blacksburg, Va., Bul. No. 195, Dec. 1951.

"Keeping up on the Farm Outlook," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. No. 201, Dec. 31, 1951, K. Hobson.

"The Washington Peach Industry," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Sta. Cir. No. 144, May 1951, E. L. Baum and K. R. Norell.

"Farm Size and Land Use in the Wheat-Pea Area of Washington and Idaho, 1935-1950," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Sta. Cir. No. 169, Sept. 1951, E. B. Hurd and O. L. Brough, Jr.

"Analysis of Factors Influencing Cotton Yields and their Variability—With Special Reference to the Upper Piedmont and West Texas Rolling Plains," USDA, Wash., D. C., Tech. Bul. No. 1042, Oct. 1951, J. L. Fulmer and R. R. Botts.

"How is the Wheat Agreement Working?" Pro. and Mktg. Admin., USDA, Wash., D. C., Agr. Info. Bul. No. 74, Jan. 1952.

"1951 Acreage and Production With Guide Comparisons," Pro. and Mktg. Admin., USDA, Wash., D. C., Dec. 19, 1951.

"1952 Production Goals Handbook," USDA, Wash., D. C., Jan. 1952.

Inventorying Soil Improvemement . . .

(*From page* 22)

bearing on the potash tests is the fact that, due to our research work in New Hampshire, we have found a significant need for potash in legume production. This is specially pertinent for alfalfa and ladino clover around which most of our modern farming practices are being built. Due to these findings, extension teachings, other publicity surrounding the need for potash, and the certain response which potash brings when applied to pastures and haylands more potash is being used in the State today than ever before. Instead of taking the farm payments just for superphosphate and lime as was the case in the early ACP days, farmers are now convinced that it is better to use a fertilizer containing both potash and superphosphate than just superphosphate alone. This increased use of potash during the past few years may account in part for the higher potash readings in the Merrimack County tests, since these farmers had two more years to engage in an accelerated potash application program.

Rapid soil tests should not be regarded as foolproof. They do give some indication of the level of fertility in any particular location and are probably more accurate for pH values than for other nutrients. Nevertheless, it is believed that they do, in a summary of this sort, give some indication of the progress which has been made in soil improvement during the past few years, progress that has brought infinitely better hay, pasture, and silage crops to our farmers than they have ever before enjoyed.

Experts Detect Mislabeled Seed

THE picture of the lean figure of Sherlock Holmes holding a magnifying glass before his eyes to examine "clues" is an old favorite with readers of detective fiction. Some of the later sleuths seem to place less reliance on the hand glass, but in real life it is one of the basic tools used by U. S. Department of Agriculture specialists in enforcing the Federal Seed Act. This law is for the protection of farmers against those who seek a dishonest profit in selling seed that is mislabeled.

Use of magnifying glass figured in recent cases dealing with marketing of alfalfa seed. In the northern states farmers need hardy alfalfa to withstand cold winters. If they plant alfalfa seed adapted only in the irrigated areas of the Southwest, most of the plants may be killed by winter freezes. Thus the farmer loses the use of the land for a year or more and wastes the expense and labor of preparing the field and seeding it. Growers are willing to pay substantial premium for seed that produces hardy plants. The law provides for truthful labeling of such seed and penalizes frauds.

The magnifying glass helps detect just such frauds. The seed specialists admit that they can not distinguish by sight an alfalfa seed grown in Montana or Canada from a seed of alfalfa grown in New Mexico or Arizona. But when they scan painstakingly a sample of seed offered as northern-grown and find in it the distinctively different seeds such as silversheath knotweed, Johnson grass, and Bermuda grass, they have convincing evidence of fraud. They know that this sample is not all of northern origin because the other plants do not grow in northern alfalfa fields, but are common in alfalfa fields in the southwestern states. The magnifying glass plus years of specialized experience with the plant science of seed identification makes the evidence conclusive.

The seed laboratory has other ways of detecting false labeling, but the magnifying glass is one of the important tools.

Pilot Research Farms

ONE "tentative recommendation" in the Family Farm Policy Review program the U. S. Department of Agriculture is presenting for consideration by farmers as individuals and groups is the proposal for "pilot research farms," quite distinct from "demonstration" farms.

Each farm of this type, says the Agricultural Research Administration, would be "representative of an important soil association area." On pilot research farms "the most advanced knowledge available to researchers in agriculture and in family farm living might be tried out in a whole-farm operation. On them, agricultural scientists would discover the potentialities of various combinations of advanced practices. They would be analogous to pilot plants at which research in chemical or mechanical processes is carried beyond the laboratory scale."

The Bureau of Agricultural Economics develops the same idea, saying: "The most promising results need to be combined into farming systems that appear best suited to the soil resources and market outlets in different areas. Operators of small farms with limited resources cannot afford to experiment with new developments. This approach needs to be considered on a Department-wide basis in cooperation with the Land Grant Colleges. . . . Such farms are specially needed in areas of small farms where major agricultural changes seem desirable. Re-

sults of plant and animal experiments and economic research can be combined and tested in a practical system."

The Department also gives heed to the value of "pilot research" as a practical way of finding out the investment and credit requirements of changes that improve production. Such practical farm-scale experimentation would also be a guide to bankers and to the credit agencies in the Department in gauging the productive and profit possibilities of technical and scientific improvements in farm methods.

Home-Grown Grass Seed

INCREASED harvesting of seeds of grasses and legumes as a necessary part of the Grassland Farming Program is being encouraged by the U. S. Department of Agriculture. The Soil Conservation Service has issued a handbook giving pointers on how to judge whether a field is developing seed enough to make it worth harvesting, and also on harvesting, curing, and cleaning the seed for sale. Seed-harvesting machinery varies from simple to elaborate, and farmers making a specialty of grass-seed-growing for the market will benefit by close observation and continued experimentation.

For the individual farmer who wants to grow more grass from his own seed, the Soil Conservation Service suggests a much simpler and easier method that yields good results under many conditions:

"A farmer who harvests only a few acres for increased plantings," says the handbook, "usually does not need large equipment. He seldom needs to clean the seeds to meet commercial standards. He may want to cut low-fill material. Often he can meet his increased seeding needs by cutting or stripping the mature grass and scattering the uncured seedhay over the field to be seeded."

New Bluegrass Good in Lawns

A NEW widely-adapted bluegrass called Merion (B-27) was released in 1950 by the U. S. Department of Agriculture and the U. S. Golf Association Green Section after 12 years of cooperative testing. Now under increase in many parts of the country, this strain of bluegrass was found by the superintendent of a golf club near Philadelphia, who observed it for several years and then sent a plug of the turf to the Green Section.

After the years of testing, Dr. Fred V. Grau, Director of the U. S. G. A. Green Section, describes Merion as markedly superior to ordinary commercial bluegrass and gives many reasons for this high rating—resistance to the destructive fungus leafspot (Helminthosporium); low growth habit that enables it to stand mowing better than common bluegrass coupled with less need for frequent mowing in lawns; rapid spread; vigor of its underground stems (rhizomes); resistance to weed invasion; tolerance of heat and drought; ability to thrive in partial shade; and production of a good yield of strong and plump seed that can be distinguished easily from seed of common bluegrass.

Many seed dealers are now ready to supply Merion seed, but the price is high and so is the demand. The widespread tests indicate that Merion can be grown throughout the range of Kentucky bluegrass, either alone or as part of mixtures for lawns as well as for golf courses and other places requiring a grass cover that will stand up under wear.

Alabama's Experience with Alfalfa . . .

(*From page* 8)

be maintained. Most alfalfa fields in Alabama should be topdressed annually with 900 to 1,000 pounds of 0-12-20 containing 20 to 25 pounds of borax per acre after the first year in which the alfalfa was established. This fertilizer should be applied in February before growth starts or after the first cutting is made in the spring. On light soils subject to rapid leaching and on heavy soils too wet to get on in early spring, applying fertilizer after the first cutting is desirable.

Alfalfa Varieties Adapted to Alabama

Alfalfa varieties that have proved satisfactory for use in Alabama are Kansas Common, Texas Common, Oklahoma Common, Buffalo, Argentine, and Williamsburg. These have always been winter-hardy and have produced yields at or near the top in all tests. Farmers should be very cautious in planting varieties other than these, as non-hardy varieties are frequently winterkilled in Alabama.

Pastures Pay Profits . . .

(*From page* 26)

This station is doing a splendid job in providing year-round grazing on four types of permanent pasture. These include Kentucky 31 or Alta fescue and either Louisiana white Dutch clover or ladino clover; Dallis grass and Kobe lespedeza; lespedeza sericea and crimson clover; Dallis grass, Bermuda grass, and Louisiana white Dutch clover.

Almost unbelievable results have been obtained at the new experiment station near DeRidder. This also is located on sandy, cut-over, piney woods land. Pastures have been established by removing all the stumps, plowing with heavy disc plows in July and August, letting the land remain in this condition for three or four weeks, then applying one ton of limestone and 500 pounds of 3-12-12 or 6-8-8 fertilizer per acre, disking the land thoroughly, and then seeding to white Dutch clover. In the spring Dallis grass and common lespedeza are added. We saw pastures which had carried from one to two mature animals per acre from January 14 to the middle of May. These cattle were as fat as any we have ever seen on any kind of pasture at any time of the year.

In producing such pastures the station emphasizes the importance of farmers following all essential practices, including seedbed preparation, liming, fertilizing, and seeding. If any one of these practices is omitted, unsatisfactory results will be obtained.

Fescue grass and Louisiana white Dutch clover have produced wonderful winter and spring pasture at the various stations. In establishing this combination, 15 pounds fescue grass per acre are seeded in early September and rolled in with cultipacker. The seed germinates and grass starts growing after the first few showers. About the first of October and during a shower or with a good season in the soil, Louisiana white Dutch clover seed is broadcast on top of the fescue without any further preparation at the rate of 5 to 8 pounds of seed per acre. The pasture is maintained by applying

Fig. 2. At the Southeast Louisiana Livestock and Dairy Experiment Station, sweet Sudan grass gave heavy grazing and high returns on well-prepared, heavily fertilized land.

500 pounds 3-12-12 per acre, broadcast in the fall with an automatic spreader.

At the new Red River Valley Station near Shreveport, both winter-grazing crops and permanent pastures had produced so much growth the Station did not have enough cattle to graze all of it. Johnson grass had proved to have a high carrying capacity during the summer months when permanent pastures may be dry. Oats alone and oats and southern winter peas provided heavy winter grazing. Dallis grass and either Louisiana white Dutch clover or ladino clover or Kentucky 31 fescue and ladino clover seem to offer the best combination in this area for permanent pastures.

The station at St. Joseph is located in the heart of the Louisiana delta. Permanent pastures of Dallis grass and white clover were established on heavy buckshot land which had been lying idle for more than 20 years. This land had not been cultivated because it was too hazardous for cotton or other cultivated crops. These pastures over a period of eight years have produced from 350 to 400 pounds of beef per acre. No fertilizer has been used on these delta soils. The only cost has been the construction of V-type ditches to drain off surface water, fencing, seedbed preparation, and seeding. There are thousands of acres of similar land in the Louisiana and Mississippi deltas now lying idle which can be made to return $50 to $100 per acre at little cost.

Probably the greatest single opportunity facing Southern farmers is in the establishment of improved permanent pastures and the growing of winter-grazing crops for beef cattle, hogs, sheep, and dairy herds. Pasture yield is in proportion to the amount of fertilizer used. Personally, we believe that much larger quantities of fertilizer will be used in the future on permanent pastures. Farmers should visit their experiment stations and determine the best seeding mixtures for their particular soil types and for the different seasons of the year. It is also advisable to have soils tested in order to determine the right amount of lime to be used.

The Relative Merits . . .

(*From page* 12)

balanced supply of nutrients, is the determining factor in increasing yields by this method? This point was well established by the writer and Dr. Tiedjens during the sweet potato survey conducted at the N. J. Station more than a decade ago.

Summing up the discussion of this function, it is clear that the only point in favor of the organic sources of nutrients is their capacity to supply hormones and perhaps vitamins. These substances are not to be found in mineral fertilizers. There is, however, good reason to believe that vitamins are generated in the soil by microbes and by the many other biochemical reactions that take place in the soil as a result of stimulation and catalysis of the mineral fertilizer salts. And, besides, the effects of hormones and vitamins in the soil are still a terra incognito.

3. **Release of CO_2 and Intermediate Decomposition Products in the Process of Humification and Mineralization:**—One of the most important plant nutrients supplied by organic sources *only* is CO_2. Mineral fertilizers containing carbonates do furnish some CO_2, but the total is rather negligible. On the average, plants contain 40-45% C which comes from CO_2. Naturally, in the process of humification and mineralization of organic materials (manures, composts, etc.) the released CO_2 may serve as a nutrient. This takes place if the gas is removed from the source of origin—the A_p layer—into the air above ground. However, if for any reason the gas exchange between the soil air and that above ground is impeded, the so-called beneficial nutrient (the CO_2) may become a curse. A concentration of CO_2 above 1% in the rhizosphere is toxic to the average plant. Many crop failures may be traced to such a condition whenever fresh manures or those rich in bedding of a high C:N ratio are used. Soils that tend to be on the wet side easily create a high CO_2 concentration, and incidentally a low O_2 concentration in the rhizosphere, even with composted manures, let alone with fresh manure.

Summarizing the functions of CO_2 in the light of the subject under discussion, it would seem that organic sources of plant nutrients have the edge over mineral fertilizers. Still, the fact that CO_2 concentrations at the rhizosphere may raise havoc with a crop is a strong negative factor to be reckoned with.

4. **Cation Exchange Capacity and Buffer Factors:**—In its capacity to supply nutrients, the cation exchange factor is grossly over-estimated. A quick calculation tells us that 10-15 pounds of nutrients (Ca, Mg, K, Mn) per acre may be retained by the exchange complex of a 10-ton application of manure, or similar material. A few handfuls of dolomitic lime and a pinch of muriate will supply these elements. As to the buffer capacity of manures, its importance is proportional to that of the exchange capacity and is of a temporary nature.

5. **Soil Structure Improvement:**—This function is one of the few with which organic sources of nutrients affect crop yields not by way of nutrition, but by improving the physical condition of the soil, presumably its structure. This is an environmental factor which mineral fertilizers supposedly do not provide. However, *mineral fertilizers are instrumental in increasing the yield of roots which are superior to manure in their capacity to improve soil structure.* This fact has been known to pedologists ever since the days of Dokuchaev, Sibirtsev, Kostychev, and others. From time to time this fact is being rediscovered, as in

the paper by Peerlkamp[3] presented to the Fourth International Congress of Soil Science held in the summer of 1950. Besides, rooting with manure is by far less extensive than with mineral fertilizer.

As a matter of fact, if we examine the records of the experimental work on manure versus mineral fertilizers, we find that manure plots, as a rule, are ahead of mineral fertilizer plots during the first year or two. After that, the differences disappear, with the manure plots falling behind from time to time. The cause is the relative ineffectiveness of manure or of any other type of organic material to improve the soil structure. What these materials do to the soil is not so much of an improvement in soil structure as an increase in volume which brings about more efficient movement of water under average conditions of well-drained upland soils.

The lag of the fertilizer plots to produce sufficient root growth during the first season is responsible for its relatively poor showing. After that the extensive root growth in the fertilizer plots begins to show its effectiveness on soil structure. The infrequent failures of the manured plots in later years may readily be traced to poor aeration brought about by the manure in wet seasons. Under conditions of low oxidation-reduction potentials, which prevail during wet seasons, the structure deteriorates, and this is more noticeable in the manured plots.

From the short discussion presented, it should be clear that with mineral fertilizers, lime, and gypsum one may obtain a more efficient and more natural supply of desirable organic matter in the form of roots than from manure or composts.

6. Moisture Capacity:—None of the functions of organic matter have been so misinterpreted as the one on moisture capacity. It is true that manure may carry 300-400% moisture, and peats may have a still higher moisture-holding capacity. However, manure or a green manure crop is rapidly decomposed, especially in light soils. After 5-8 weeks more than half would be no more. A 10-ton application of manure would by then have a moisture-holding capacity of 8,000 pounds per acre, enough to produce 12-15 pounds of dry matter. Besides, not all of the water is available because of the high hygroscopic coefficient of organic matter.

7. Temperature Effects:—It is claimed that the rise in temperature due to the release of heat in the process of decomposition might have a favorable effect on the soil temperature. Not much work has been done to test the validity of this claim or the magnitude of this effect.

8. Microbial Flora:—One of the exorbitant claims made by the protagonists of organic farming, and especially the vendors of composts, is that the organic sources of nutrients increase the soil microbial population. But, what is the advantage of that, if any? As a matter of fact, it has been shown that the enhanced activity of the microbial flora may cause the immobilization of N and disturb the balance of nutrients in the soil. These harmful effects may last several weeks during which time the crop may be set back or ruined. These disturbances have not been known before the introduction of mechanization and specialization.

9. Residual Humus:—Reference is frequently made to the residual humus left behind after the growing season whenever organic sources of nutrients, such as manures, are used. Generally, this claim is not based on actual analyses, which are not sufficiently refined to detect the residual humus. Occasionally one may find undecomposed organic material. This should be looked upon as evidence that the

[3] Peerlkamp, P. K. 1950. The influence on soil structures of the "Natural Organic Manuring" by roots and stubble. Trans. Fourth Inter. Congr. Soil Sci. 1:50-54.

soil perhaps had suffered from poor aeration.

Undoubtedly, in the old days when 30-40 tons of manure had been incorporated into the surface 4-5 inches (not buried to a depth of 10 inches as done now by a tractor-drawn plow) there was a chance for some accumulation of residual humus. With 5-10 tons of manure, very little humus is left behind, especially in light soils. Of course, this humus is a desirable feature, and by the judicious use of mineral fertilizer and cover crops one may obtain a superior type of organic material from the roots which can be stimulated to greater vigor with mineral salts than with manure.

Whereas green manures, composts, and other organic materials may be substituted for animal manure, their use is associated with a great many difficulties, a discussion of which would take much time. We shall therefore sum up by the utterances of any good farmer who knows how to farm with manure: "There ain't no good substitute for animal manures."

Of course, there is the possibility for a blend of inorganic and organic plant nutrients which could be made the ideal combination. It would carry the specific virtues of the organic materials not found in mineral fertilizer as well as the specific virtues of the mineral salts not found in the manure. However, there are several factors and conditions which limit the chances for attaining the ideal combination. First of all, we cannot as yet measure or foretell accurately the course of the reactions of the organic materials, especially the N availability. Neither is it possible to overcome satisfactorily the other shortcomings mentioned earlier. Secondly, there is the paucity of manure in the areas where most needed, such as truck crop areas, special fruit crops, and a few others, because of mechanization and specialization.

Summing up the story on the relative merits of inorganic and organic sources of plant nutrients one must come to the conclusion that there is no ground for the claims on the superiority of the exclusive use of organic sources. If anything, mineral fertilizers have a great advantage, inasmuch as their use may be readily manipulated to fit the type of salts and time of application in accordance with the crop requirements and soil conditions.

Appendix

In the discourse on the relative merits of inorganic and organic sources of plant nutrients reference was made to protagonists of organic farming. Their diatribe carries an ostentatious veneer of science, actually pseudo-science, the kind that appeals to the uninitiated general public. Bits of truth and half-truths are skillfully blended into a palatable concoction, readily consumed by a gullible clientele. The organic farming faddists have developed a strong emotional appeal—they predict the doom of mankind and threaten the world with destruction if mineral fertilizers are not banned and substituted with organic sources of nutrients. These fanatics intimate the dangers of becoming victims of dreadful incurable diseases resulting from eating food products raised with mineral fertilizer. They speak of ruining the soil with chemicals.

A sober review of the publications of the leading lights propagandizing organic farming from across the seas and in our own U.S.A. shows there is not one amongst them versed in the fundamental concepts of soil science. Their writings display complete ignorance of the subject, replete with abusive utterances, boisterous unfounded statements, and rash and misleading deductions.

It would serve no good purpose to enter into a critical analysis of these writings. These fanatics are not in a state of mind to appreciate how little they know about the subjects they touch upon. There is no way of penetrating the barriers they have con-

structed against learning basic facts of science.

Among the exponents of organic farming are undoubtedly some well-meaning ladies and gentlemen. Their appeal to save the world keeps them aloof from any criticism. In any argument they expose immediately a defense mechanism bordering the irrational.

Unfortunately, as a result of the propaganda of the well-meaning but misguided individuals we have on the market all kinds of organic nostrums. The vendors of these distort still more the scientific facts about soils and plant growth. The truth of the matter is that besides fleecing their customers the vendors and propagandists of organic farming are guilty of causing the waste of huge quantities of organic materials which when judiciously used in combination with mineral fertilizer would go a long way in producing more and better food so much wanted the world over.

Master Cotton Farmer . . .

(*From page* 24)

came two weeks later when he used 200 pounds of 4-10-7 and 100 pounds of 60% muriate of potash.

Insects did not create a serious problem, which is credited to a cold winter and an extremely dry summer. The crop was checked almost daily for weevils, but infestation counts never got higher than 5% and the crop was poisoned from one to three times in late July. July weather was very dry, which proved to be a blessing from the weevil standpoint, but after 60 days without appreciable rain the crop threw off many squares and half-grown bolls in late August and September.

The first bale was picked and ginned on August 19 and the 120th bale was ginned on November 1. Stalks were cut, the land turned, and vetch planted in preparation for the 1952 crop. This method worked fine in the dry season

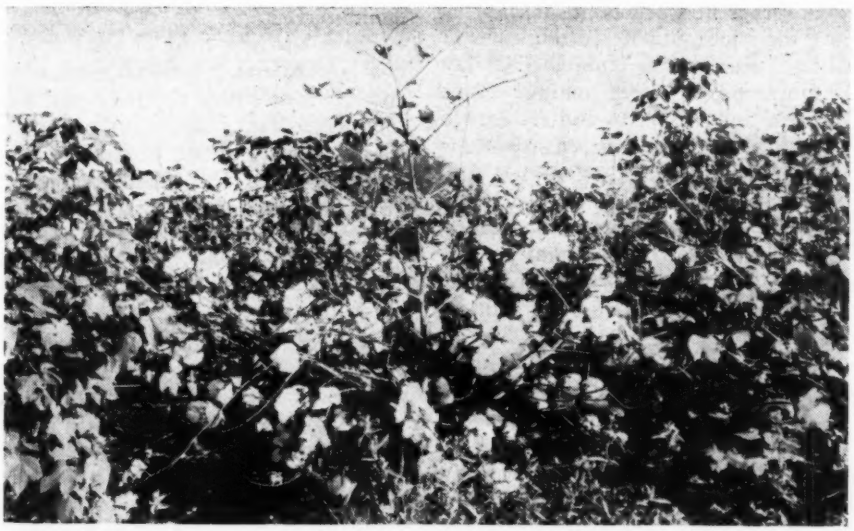


Fig. 3. No plant-food deficiency here. Mr. Morris pulled this stalk from his field on September 15 and hung it in the barn to allow all bolls to fully open. This picture shows 154 open bolls.

of 1951. Farmers have asked what would have been the results had the weather turned off wet. Of course, we can only guess that if the crop can be planted early and can get up to a good stand before the rain sets in, little trouble will be experienced. Cotton planted this thick makes heavy foliage and will completely shade the middles and rows after eight weeks, thereby eliminating weed competition.

Many cotton acres will be planted this year in Shelby and surrounding counties using the "Defford Morris Method." Farmers have an old saying that when cotton goes to 40¢ a pound, many of us "town boys" who are not many years removed from following a mule ourselves, are prone to contract a disease known as "cottonitis fever." After following this record cotton crop all year, the writer has rented 100 acres of cotton land three miles west of Defford Morris's farm and, the bank permitting, will be shooting for a bale and a half acre crop, using the methods as previously outlined by our farmer friend, Defford Morris.

Gullible's Ravels . . .

(*From page* 5)

lions from such ideas submitted under the employee incentive deal. Down in New Orleans a systematic fiscal procedure was put into motion for doing routine financial tasks in a simpler way to save manpower and machines which ran well into six figures of net savings —and almost every issue of current employee bulletins lists names and awards made to encourage accuracy, timeliness, and economy.

Government workers are not frozen into their jobs either. Incompetent or disloyal ones can be eliminated as fast as ample proof is forthcoming. Some of them find other jobs and resign. In the last fiscal year the records show that 321,437 workers voluntarily quit their jobs. During that year 17,288 persons were given their walking papers for various good reasons; and another group of about 17,000 were separated from the payrolls owing to reduced funds and a consequent cut in force.

Salaries paid to Federal personnel who are in the lower and medium grades of civil service usually amount to more than corresponding job assignments outside in private industry. But along in the upper brackets demanding a high degree of supervisory or administrative skill, it is often true that the corporation outbids the government in its scale of pay. There is a career service wage ceiling fixed by law at $14,800 per year.

Self-betterment and initiative are encouraged through existence of numerous professional working groups and societies, and the Agriculture Department maintains a graduate school with several thousand students taking special courses in the sciences, arts, letters, and public service.

There is a big field of joint operation or partnership between the leaders and scientists within the industrial and commercial ranks and many of the research agencies of the Federal government. So vast and complex are this growing division and unity (division of duty and opportunity, and unity of objective) that it is often hard to tell where the most credit lies for final achievements. Federal scientists in the Bureau of Standards, the Bureau of Agricultural and Industrial Chemistry, the Atomic Energy Commission, and a great portion of the advancement under the Research and Marketing Act of 1946, as well as in the synthetic fuels and power use studies of the Department of the Interior—just to scrape up a few—are linked constantly in mutual

discoveries with private laboratories.

Moreover, companies and associations of progress in scientific and economic lines often make honorary recognition or cash prize awards to leaders within the Federal service for their contributions to a common cause. So it means that in the real work of the world, as between men of science and technical profundity, there exists a deep mutual respect—a sense of kinship toward the foreseeable future that totally escapes all the blather and critical bitterness so often voiced by small and ignorant minds. Of course, there remains enough of that normal, healthy sense of pride and competition to cause scientists and investigators to bestir themselves, each in his own corner, to germinate basic science into applied technology. It is also true that sometimes private laboratories draw top men away from the government service. This would not be very awkward or disrupting were it possible to rely upon continuing public funds to draft new and promising talent, which in tight budget times are often denied or postponed indefinitely.

Discoveries in the realm of antibiotics for surgery and medicine are milestones erected to the credit of private chemists and those who work for the Department of Agriculture at Peoria, Illinois. Similarly, in the subsequent development of antibiotic substances and vitamins in various combinations for reinforcement of livestock and poultry feeds we again have teams of government and industry associated together. In the soils and fertilizer fields more such cooperation is going on, some of it connected with the radioisotope experiments, and others with the role of minor plant foods in balanced growth and yield studies.

In a recent treatise by a noted chemical company on the history of chemistry, government achievements in the laboratory are listed prominently. The chemists in the Eastern Regional Research Laboratory overcame a serious operating problem which contributed to a substantial increase in the output of synthetic rubber. Besides finding a short cut that saved about $10 million in operating costs, they helped to retain a valuable market for farm by-products while making synthetic tires of better quality.

An analyst at the Bureau of Standards used an ether extraction process for the analytical separation and determination of uranium in the late 1930's. Uranium was then little regarded, and the experiment did not come into full power and value until the atom bomb emerged. Then an urgent cry went forth for uranium oxide in commercial quantities. Thereupon they dusted off the formula reposing in the Bureau of Standards and found that the ether extraction process solved most of the difficulty in getting pure basic metal for engendering atomic energy.

A SCORE of 2 to 1 in favor of bright and imaginative minds in the Federal service came as a result of a national contest for the best productive technical ideas. It was sponsored by the National Association of Suggestion Systems. Many entries were made, both from industry and Federal agencies. First prize was won by a fleet boss in the Bureau of Vessel Custody at Jones Point, N. Y. He developed a water-blast system of taking scale from ships at a saving of $230,000 during the first year, and finally of over a million dollars when used on all the reserve fleet.

Now let's scan the list of examples of Federal workers who have received medals, awards, and tributes from fellowcrafters and highly regarded associations of industrialists. Naturally, a full list even for a couple of back years would be long and tiresome, so just a few will do.

Distinguished achievement in improving the technique and practice of finding and producing petroleum was awarded with a medal by the American Institute of Mining and Metallurgical

Engineers to Dr. William E. Wrather, Director to the U. S. Geological Survey.

Dr. Thomas L. McMeekin, a Department of Agriculture Chemist, got the 1951 Borden award and medal, administered by the American Chemical Society, for outstanding contributions to the chemistry of milk proteins. He is only one of seven past and present scientists in the Department who have received this same award during the past 12 years.

Dr. Wendell P. Woodring, U. S. Geological Survey, was honored with the Penrose medal of the Geological Society of America—its highest award made only in those years when some outstanding achievement warrants it.

Dr. Hugh H. Bennett, former Chief of Soil Conservation Service, was awarded the distinguished service certificate and plaque this year by the American Agricultural Editors Association, and was also listed in Popular Mechanics magazine's recent national roll of outstanding contributors to progress.

Personal bravery and adherence to duty at the risk of life and limb are also noted and suitable recognition accorded. Government field workers in Forest Service and the Bureau of Reclamation have many such citations to their lasting credit—sometimes with grade promotions. The Civil Service Commission recently sent to Congress a list of more than 1,000 superior accomplishments. These award citations concern within-grade salary step-increases, varying according to law from $60 to $250 a year, depending upon the classified job the person holds.

Persons in government employment who initiate an idea, device, or method which increases efficiency or causes substantial savings in the public service may receive either a within-grade promotion or a cash award under Public Law 600, 79th Congress. No person may get both, however.

Almost every year the principal executive departments of the government stage honor ceremonies to give public recognition to the most outstanding achievements accomplished during the year, both by Washington personnel and those in the field offices. Committees from outside the departments and bureaus usually act as judges and pick the deserving names from a good-sized nominating list submitted by supervisors. Not only is this a distinguished ceremony at the nation's capital, but quite frequently the persons who win such tributes in the field are in line for little parties and gatherings among their friends and co-workers locally. Humble men and women who ask only for a chance to perform obscure tasks with decency and dignity are thus saluted by their associates, and they keep those parchments proudly in their treasure chests until the end of their careers.

IN all this complexity of life and its misunderstandings, we are apt to set the Federal employees off in a sort of compartment by themselves as though they never cooperated with or had any official relations with the employees of the states and municipalities of the nation.

We count up so many of these and so many of those, and bewilder the taxpayer with what we call duplication and waste in the work of Federal and local government employees. Maybe while we are doing this we complain about poor police protection, lax food inspection rules, unfair prices, and less frequent and efficient mail deliveries.

But take a moment to recall that the Federal and State employees are playing together as a trained team in the field we know best—agricultural research and agricultural extension, or teaching and demonstrating.

Every single State experiment station —even far-off Alaska, Hawaii, and Puerto Rico—has a direct and constant tie-in with the routine programs of cooperative research embodied in the so-called Agricultural Research Administration of the Federal government. As a special and necessary link and coor-

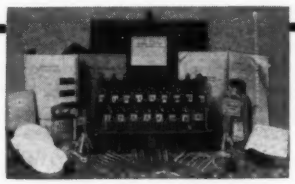
dinating force, we have the Office of Experiment Stations. It is concerned directly with the achievements at the State level and the ways in which the best ideas and results out there are fitted into the whole picture.

Almost every week or so there is some committee in session either at Washington or at some regional spot afield where the best minds meet to mull through the plans and perfect the teamwork between the men who happen to reside at Washington and the others working at Manhattan, St. Paul, Wooster, Madison, or Berkeley. Not only are programs and arrangements pooled, but joint regional publications and announcements are forthcoming. The idea is to dedicate all the resources of this twin engine of science to the final welfare of producers and consumers.

Many of the men now working at State stations once worked for Uncle Sam, while some of the best Federal skills have migrated back to the States in pursuit of some particular investigation best studied "on the spot." The connections are too close and strong to distinguish one from the other.

Furthermore, with so many foreign programs facing us as a challenge to progress and democratic ideals, this blend of men of good will on Federal and State fronts is absolutely vital and indispensable. Locally, these State and county researchers and extension men and women are representatives of both the local or regional and the Federal service. Everybody knows them and the vast majority respect them. Many are in work shirts and overalls, and all have their sleeves rolled up to perform honestly and fairly for the pay they receive. That's my conception of State-Federal service. The shabby and tiny minority who behave against the best tradition can be checkmated if our citizens uphold the standards of public service and quit belittling and browbeating those who do the nation's chores.

NO_3 Ca
P *The Spurway* NH_4
K *Method gives* NO_2
pH CO_3
Fe *you much more* SO_2
Mg *—for less—* Cl
Na Mn
Al



Simplex
SOIL TESTING IS ACCURATE

and designed for the use of non-chemists.

THE COMPLETE SOIL TEST OUTFIT is practical for use in any locality—requires no waiting — allows for frequent, yearly tests. Contains all the solutions and apparatus necessary for 100 to 300 soil tests for each of 15 important soil chemicals including trace elements, plus tissue tests for Nitrates, Phosphorus and Potassium. $43

THE JUNIOR Simplex Soil Test Outfit — Contains all the materials and solutions necessary to make 100 to 300 tests for each of 6 soil chemicals plus tissue tests for N-P-K. $28

THE FARM Simplex Soil Test Outfit—Designed for the smaller grower, it contains 100 tests for 5 soil elements plus tissue tests for N-P-K. $21

All outfits shipped via Railway Express F.O.B. Norwalk, Ohio

Write for descriptive literature

Prices subject to change without notice

THE EDWARDS LABORATORY

P. O. Box 318-T Norwalk, Ohio

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Better Corn (Midwest)
The Cow and Her Pasture (General)

Reprints

F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What Is the Matter with Your Soil?
J-2-43 Maintaining Fertility When Growing Peanuts
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
A-1-44 What's in That Fertilizer Bag?
QQ-12-44 Leaf Analysis—A Guide to Better Crops
P-3-45 Balanced Fertility in the Orchard
Z-5-45 Alfalfa—The Aristocrat
OO-8-45 Potash Fertilizers Are Needed on Many Midwestern Farms
ZZ-11-45 First Things First in Soil Fertility
T-4-46 Potash Losses on the Dairy Farm
Y-5-46 Learn Hunger Signs of Crops
I-2-47 Fertilizers and Human Health
T-4-47 Fertilizer Practices for Profitable Tobacco
AA-5-47 The Potassium Content of Farm Crops
TT-11-47 How Different Plant Nutrients Influence Plant Growth
VV-11-47 Are You Pasture Conscious?
R-4-48—Needs of the Corn Crop
X-6-48 Applying Fertilizers in Solution
AA-6-48 The Chemical Composition of Agricultural Potash Salts
GG-10-48 Starved Plants Show Their Hunger
OO-11-48 The Use of Soil Sampling Tubes
TT-12-48 Season-long Pasture for New England
F-2-49 Fertilizing Tomatoes for Earliness and Quality
CC-8-49 Efficient Vegetable Production Calls for Soil Improvement
KK-10-49 An Approved Soybean Program for North Carolina
QQ-11-49 Some Fundamentals of Soil Building
RR-11-49 Alfalfa as a Money Crop in the South
SS-12-49 Fertilizing Vegetable Crops
F-1-50 A Simplified Field Test for Determining Potassium in Plant Tissue
I-2-50 Boron for Alfalfa
K-3-50 Metering Dry Fertilizers and Soil Amendments into Irrigation Systems
L-3-50 Food for Thought About Food
O-4-50 Birdsfoot Trefoil—A Promising Forage Crop
S-4-50 Year-round Green
V-5-50 Potassium Cures Cherry Curl Leaf
X-5-50 Fertilizers Help Make Humus
Z-6-50 Potash Tissue Test for Peach Leaves
AA-8-50 Alfalfa—Its Mineral Requirements and Chemical Composition
BB-8-50 Trends in Soil Management of Peach Orchards
HH-11-50 The Minor Element Problem
II-11-50 Tree Symptoms and Leaf Analysis Determine Potash Needs
KK-12-50 Surveying the Results of a Green Pastures Program
NN-12-50 Plenty of Moisture, Not Enough Soil Fertility
A-1-51 Soil-testing Reduces Guesswork
B-1-51 Alfalfa, Queen of Forage Crops
G-2-51 Grassland Farming Brings New Management Problems
I-2-51 Soil Treatment Improves Soybeans
J-3-51 Fertilizing the Corn Crop in Wisconsin
K-3-51 Increasing Cotton Yields in North Carolina
M-3-51 A Look at Alfalfa Production in the Northeast
N-4-51 Nutritional Problems of Peanuts in Southeastern Alabama
O-4-51 More Corn at No Extra Cost
P-4-51 Thirty Tons of Tomatoes per Acre
S-5-51 The Development of the American Potash Industry
W-6-51 Does Potash Fertilizer Reduce Protein Content of Alfalfa?
X-8-51 Orchard Fertilization Ground and Foliage
AA-8-51 Topdressing Legume Meadows in Iowa
BB-10-51 Healthy Plants Must Be Well Nourished
CC-10-51 Producing Small Grain More Efficiently
DD-10-51 Fertilizers for Vegetable Crops, Rates, Placement, and Ratios
EE-10-51 Rotation Fertilization
FF-10-51 Soil-fertility Losses by Erosion
GG-11-51 Fertilizer Recommendations Based on Soil Tests
HH-11-51 Concerning "Bio-dynamic Farming" and "Organic Gardening"
II-12-51 Pasture Improvement With 10-10-10 Fertilizer
JJ-12-51 Soil Fertility and Pastures
KK-12-51 Potassium in Animal Nutrition
A-1-52 Research Points the Way to Higher Levels of Peanut Production
B-1-52 Simple Tests for Magnesium and Calcium in Plant Material and Magnesium in Soils

---

THE AMERICAN POTASH INSTITUTE
1102 16TH STREET, N. W. WASHINGTON 6, D. C.

FREE LOAN OF EDUCATIONAL FILMS

The American Potash Institute will be pleased to loan to educational organizations, agricultural advisory groups, responsible farm associations, and members of the fertilizer trade the motion pictures listed below. This service is free except for shipping charges.

FILMS (ALL 16 MM. AND IN COLOR)

The Plant Speaks Thru Deficiency Symptoms (Sound, running time 25 min. on 800-ft. reel.)
The Plant Speaks, Soil Tests Tell Us Why (Sound, running time 10 min. on 400-ft. reel.)
The Plant Speaks Thru Tissue Tests (Sound, running time 14 min. on 400-ft. reel.)
The Plant Speaks Thru Leaf Analysis (Sound, running time 18 min. on 800-ft. reel.)
Save That Soil (Sound, running time 28 min. on 1200-ft. reel.)
Borax From Desert to Farm (Sound, running time 25 min. on 1200-ft. reel.)
Potash Production in America (Silent, running time 40 min. on 400-ft. reels.)
In the Clover (Sound, running time 25 min. on 800-ft. reel.)

OTHER 16 MM. COLOR FILMS AVAILABLE ONLY FOR TERRITORIES INDICATED

South: Potash in Southern Agriculture (Sound, running time 20 min. on 800-ft. reel.)
Midwest: New Soils From Old (Silent, 800-ft. edition running time 25 min.; 1200-ft. edition running time 45 min. on 400-ft. reels.)
West: Machine Placement of Fertilizers (Silent, running time 20 min. on 400-ft. reel.)
Ladino Clover Pastures (Silent, running time 25 min. on 400-ft. reels.)
Potash From Soil to Plant (Silent, running time 20 min. on 400-ft. reel.)
Potash Deficiency in Grapes and Prunes (Silent, running time 20 min. on 400-ft. reel.)
Bringing Citrus Quality to Market (Silent, running time 25 min. on 800-ft. reel.)
Canada: The Plant Speaks Thru Deficiency Symptoms
The Plant Speaks, Soil Tests Tell Us Why
The Plant Speaks Thru Tissue Tests
The Plant Speaks Thru Leaf Analysis
Borax From Desert to Farm
In the Clover

DISTRIBUTORS

Northeast: Educational Film Library, Syracuse University, Syracuse 10, N. Y.
Southeast: Vocational Film Library, Department of Agricultural Education, North Carolina State College, Raleigh, North Carolina.
Lower Mississippi Valley and Southwest: Bureau of Film Service, Department of Educational Extension, Oklahoma A & M College, Stillwater, Oklahoma.
Midwest: Visual Aid Service, University Extension, University of Illinois, Champaign, Illinois.
West: Department of Visual Education, University of California, Berkeley 4, California.
Department of Visual Education, University of California Extension, 405 Hilgard Ave., Los Angeles 24, California.
Department of Visual Instruction, Oregon State College, Corvallis, Oregon.
Bureau of Visual Teaching, State College of Washington, Pullman, Washington.
Canada: National Film Board, Ottawa, Ontario, Canada.

IMPORTANT

Request should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternate dates if possible), and period of loan.

Request bookings from your nearest distributor

A man named Joe Hogbristle appeared in court to have his name legally changed. The judge nodded understandingly and asked what name he wanted to take.

"Harry Hogbristle," he replied. "I'm sick and tired of people asking 'Whataya know Joe?"

* * *

Item culled from some local paper: "Mrs. Blank was granted a divorce when she told the judge that since their marriage her husband had spoken to her only three times. She was awarded custody of their three children."

* * *

A tourist in the Ozarks called to the old woman sitting on the porch, "How far is it to the nearest town?"

"Pa figgers it's about 10 miles thar and about 12 back," she answered. "Which is on account of him walking straighter goin' than comin'."

* * *

You can't tell a farmer girl that a stork brings baby calves, because she knows it's the bull.

* * *

Judge, to Negro defendant: "How do you plead, George?"

George: "I pleads guilty, and I waves de hearing."

Judge: "This is rather unusual . . . I don't know that I quite understand your plea. Just what do you mean?"

George: "I means I done it and I doan wanna heah no mo' 'bout it."

A Southerner, with the intense love for his own section of the country, attended a banquet. The next day a friend asked him who was present. With a reminiscent smile he replied: "An elegant gentleman from Virginia, a gentleman from Kentucky, a man from Ohio, a bounder from Chicago, a fellow from New York, and a galoot from Maine."

* * *

College gal, making conversation on her first date: "So your name is Tom. I know George means 'lover of horses,' and Philip means 'beloved'—but tell me, what does Tom mean?"

"Business, Baby, business."

* * *

The 81-year-old man, who was as unconscious of his age as a 21-year-old, came in the house one day wet and muddy from the knees down. "I wanted to cross the creek to see about the cow," he explained. "I used to jump it clear and easy, but now every dang time I try I land in the middle. Guess I just ain't noticed it getting wider."

* * *

The Sunday school teacher had been telling a story of spring, and the miracle of the growth of the Easter lily.

"Now, children," she said, "who can tell me what it is that makes the lily spring from this little bulb?"

"God does it," said one little boy. Frantically our Bobby raised his hand and shouted at the top of his lungs, "Fertilizer helps!"

Fertilizer Borates

TWO TYPES ARE OFFERED

1 FERTILIZER BORATE, HIGH GRADE

a sodium borate ore concentrate containing the equivalent of 120% Borax.

2 FERTILIZER BORATE

a sodium borate ore concentrate containing the equivalent of 93% Borax.

Each may be obtained in both coarse and fine mesh sizes—coarse for broadcasting—fine for blending in mixed fertilizers.

Literature and Quotations on Request.

Write for Copy of Our New Boronogram.

Economical sources of the element Boron so essential as a plant food for the successful growth and development of many vegetable, field, and fruit crops. Each year increased acreages of our cultivated lands show evidences of Boron deficiencies which must be corrected.

PACIFIC COAST BORAX CO.

Division of Borax Consolidated, Limited

100 Park Ave.
New York 17, N. Y.

2295 Lumber St.
Chicago 16, Ill.

510 W. 6th St.
Los Angeles 14, Calif.

Agricultural Offices

P.O. Box 229
East Alton, Illinois

First National Bank Building
Auburn, Alabama

MANUFACTURERS OF THE FAMOUS "20 MULE TEAM" PACKAGE PRODUCTS

You will want this book

DIAGNOSTIC TECHNIQUES

For

Soils and Crops

Their Value and Use in Estimating the Fertility Status of Soils and Nutritional Requirements of Crops

HISTORICAL INTRODUCTION

by

Firman E. Bear

Chemical Methods for Assessing Soil Fertility
by Michael Peech

Correlation of Soil Tests With Crop Response to Added Fertilizers and With Fertilizer Requirement
by Roger H. Bray

Operation of a State Soil-Testing Service Laboratory
by Ivan E. Miles and J. Fielding Reed

Operation of An Industrial Service Laboratory for Analyzing Soil and Plant Samples
by Jackson B. Hester

Plant-Tissue Tests as a Tool in Agronomic Research
by Bert A. Krantz, W. L. Nelson and Leland F. Burkhart

Plant Analysis—Methods and Interpretation of Results
by Albert Ulrich

Biological Methods of Determining Nutrients in Soils
by Silvere C. Vandecaveye

Visual Symptoms of Malnutrition in Plants
by James E. McMurtrey, Jr.

Edited by Herminie Broedel Kitchen, Associate Editor, Soil Science

Specially priced at $2.00 per copy

Copies can be obtained from:

AMERICAN POTASH INSTITUTE, Inc.

1102 Sixteenth St., N. W. **Washington 6, D. C.**

See why so many FARMERS prefer it!

Ask a V-C Agent to show you some V-C Fertilizer. Look at the rich color of this properly-cured, superior blend of better plant foods. Run your hands down into the smooth, mellow mixture and let it pour through your fingers. It's mealy, loose and dry.

V-C Fertilizer is famous for its crop-producing power and its easy-drilling quality. It flows through fertilizer distributors smoothly and evenly with no caking, clogging or bridging.

The better plant foods in V-C Fertilizer are carefully selected and proportioned to become available according to the feeding schedule of the crop. That's why a V-C crop gets off to an early start of rapid growth... and then stays on the job, green and growing, vigorous and productive.

V-C Agronomists use Experiment Station and Extension Service recommendations and practical farm experience in determining the right V-C Fertilizer for each crop.

Every bag of V-C Fertilizer has behind it the research, skill, experience and resources of a national organization which has manufactured better fertilizers since 1895.

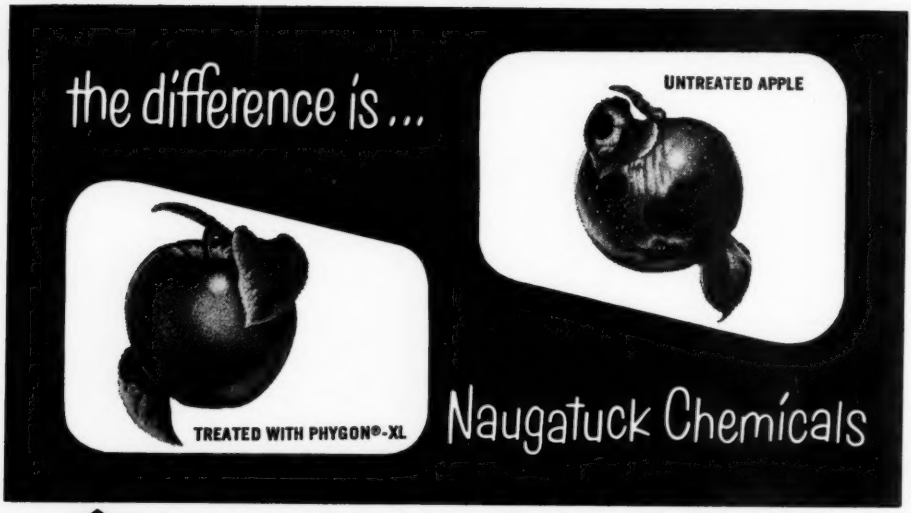
You will know why so many farmers prefer V-C Fertilizer when you see what a big difference this better fertilizer makes in crop yields and crop profits.

FERTILIZERS VC®

VIRGINIA-CAROLINA CHEMICAL CORPORATION

MAIN OFFICE: 401 East Main Street, Richmond 8, Virginia

Norfolk, Va. • Greensboro, N. C. • Wilmington, N. C. • Columbia, S. C.
Atlanta, Ga. • Savannah, Ga. • Montgomery, Ala. • Birmingham, Ala.
Jackson, Miss. • Memphis, Tenn. • Shreveport, La. • Orlando, Fla.
Baltimore, Md. • Carteret, N.J. • E. St. Louis, Ill. • Cincinnati, O. • Dubuque, Ia.



UNITED STATES RUBBER COMPANY

Naugatuck Chemical Division, Naugatuck, Conn.

manufacturers of seed protectants—Spergon, Spergon-DDT, Spergon-SL, Spergon-DDT-SL, Phygon Seed Protectant, Phygon Naugets, Phygon-XL-DDT, Thiram Naugets—fungicides—Spergon Wettable, Phygon-XL—insecticides—Synklor-48-E, Synklor-50-W—fungicide-insecticides—Spergon Gladiolus Dust, Phygon Rose Dust—miticides—Aramite.

Better Crops with PLANT FOOD

IF NOT DELIVERED, return to

AMERICAN POTASH INSTITUTE, INC.

1102—16th St., N. W., Washington 6, D. C.

RETURN POSTAGE GUARANTEED

Sec. 34.66, P. L. & R.
U. S. POSTAGE
PAID
Washington, D. C.
Permit No. 2283